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The U. S. Sugar Industry

By. Keith B. Anderson
Michael P. Lynch
Jonathan D. Ogur

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Federal Trade Commission

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Foreword

This study is the first in a new series of industry surveys that the staff of the Bureau of Economics plans to submit to the Commission for publication on a regular basis. Each survey will consist of a brief summary of the economic structure, conduct and performance of a particular industry, based on the most current publicly available information and on personal interviews with industry experts. Such surveys are certainly not intended to be definitive, exhaustive studies of the industries involved. Rather, their purpose is to collect and analyze (using the framework of the economics of industrial organization) the most current, readily available, information on those U.S. industries that are likely to be of most interest to policymakers.

The study of the sugar industry was completed in a period of three months. Basic information for it was gathered from a variety of sources: government and academic publications, the trade press and conversations with industry and government experts. All information was obtained on a voluntary basis. The Commission's authority to subpoena information (Sec. 6b of the Federal Trade Commission Act) was not used in this survey.

The Federal Trade Commission has not adopted the substance of this staff report.

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Finally, the authors would like to thank the numerous Department of Agriculture and industry officials who provided data and their own knowledge of the industry.

Summary

The sugar industry consists of three major segments: sugar cane and beet production, sugar cane grinding to produce raw sugar, and cane sugar refining and beet sugar processing to produce refined sugar. The structure of these segments differs markedly. While the structure of the first two segments closely resembles the textbook model of a competitive industry, this fact has been largely irrelevant to the determination of the price and quantity consumed of raw sugar. Until the lapse of the United States Sugar Act in December 1974, the price and quantity of raw sugar refined domestically were generally determined with unusual precision by the Secretary of Agriculture (see Chapters V and VI). Exceptions to this rule occurred in 1963 and 1974, when the world price of sugar rose above the domestic price. The latter episode will be discussed below.

The structure of the refining segment is characterized by very high seller concentration, relatively low buyer concentration, moderate economies of scale, virtually no product differentiation and a highly inelastic demand for its product (see Chapters II, III, and IV).

The structure of the industry does not appear to have changed in any fundamental way in the last sixty years (see Appendix B and Chapter III).

In spite of the fact that the Bureau of the Census classifies beet sugar and cane sugar refining as different industries, they produce a virtually identical product. They have been treated as a single industry in this study. The market for sugar is at a regional, not a national level. Seller concentration in all but one of the seven regional markets is extremely high. The top four sellers account for at least 80 percent of sales in every region except Chicago-West. The level of concentration is not explained by economies of scale in the refining process. Minimum efficient plant size for both beet and cane refining appears to be at about five percent of an average region's output. This suggests that it would be possible to have a reasonably efficient industry with four firm regional concentration levels significantly less than the 80 percent actually observed. Concentration has changed little over the entire 40 years for which census data are available (see Chapter III).

Buyer concentration is low relative to seller concentration. Industrial users account for approximately two-thirds of refined sugar sales, with most of the remainder going to direct household consumption.

The leading four industrial buyers accounted for about five percent of refined sugar purchases in 1967. The four largest nonindustrial buyers accounted for about eight percent.

Product differentiation is relatively unimportant in the sugar industry. The physical homogeneity of the product and the importance of industrial buyers have resulted in low promotional expenditures in this industry (see Chapter IV).

Little is known about barriers to new entry into sugar refining. This is the major uncertainty concerning the structure of the industry. A modern, efficient scale beet sugar processing plant costs about $30 million to construct. While this is a large amount of capital in absolute terms, it is less than the amount required in such other industries as brewing, cigarettes, petroleum, and steel. Capital barriers thus appear to be moderate. Economies of scale, though relatively low, may make entry difficult because of the highly inelastic demand for sugar. A minimum efficient scale plant would only add four to five percent to capacity in a region, but if fully utilized could lead to a fall in price of more than 10 percent unless existing plants reduced their production. Thus, the minimum efficient scale of plant seems to constitut a moderate barrier to entry. Lastly, there is the problem of assuring an adequate supply of the raw input to maintain operations at a high level of capacity. In the case of beet processing, industry experts estimate that efficient operation requires a minimum of 50,000 acres of sugar beets. Prior to 1975, any potential entrant would have had to obtain an acreage allotment from the Secretary of Agriculture. There is some evidence that allotments were not always easy to obtain (see Chapter III). There is no available evidence to indicate whether there was a similar problem in securing an assured source of raw sugar to operate a cane refinery.

The conduct of the sugar industry is reviewed in Chapters V and VI. Until this year, the domestic price of raw sugar was basically determined by the decisions made by the Secretary of Agriculture in carrying out the provisions of the Sugar Act. Over the decade of the sixties, the price of raw sugar increased at a rate of about 2.8 percent per year. This rate was slightly lower than the rate of increase in the Consumer Price Index and somewhat higher than the rate of increase in the Wholesale Price Index. For most of this period the U.S. raw sugar price was significantly above the world price, and continued to rise when the world price fell.

It was no accident that the U.S. sugar price rose at roughly the same rate as the general rate of inflation in the United States, regard-

less of any declines in the world price. The "price objective" specified in the Sugar Act required the Secretary to see that the raw sugar price rose at least at the rate of inflation. While U.S. sugar policy was very successful in protecting growers from a low and falling world sugar price, it was spectacularly unsuccessful in protecting consumers from a high and rising world sugar price. The Secretary of Agriculture failed to achieve the sugar price objective only when the world price rose above the domestic price. The inability to maintain the domestic price much below the world price is explained by the economics of the problem rather than by any shortcomings of agricultural policy. When there was a shortfall in domestic production, the only way to keep the domestic price from rising in the short run was to increase the quantity of raw sugar imported into this country. But when the world price was above the domestic price, foreign producers would not willingly oversubscribe their quotas. Additional supplies could only be obtained by paying the world price, and so the domestic price would rise rather quickly.

This study relies solely on publicly available information. On the basis of this information, there appears to be little evidence that the explosion of raw sugar prices in late 1974 was due to anything other than natural market forces. However, no extensive inquiry as to the possibility of collusive activities was made, and therefore, no conclusions regarding collusion in any segment of the industry should be drawn. World production and stocks of raw sugar were low for a variety of reasons (weather, past low prices, etc.) and there was a significant deficit in domestic production. The highly inelastic nature of demand for sugar makes the product vulnerable to very large increases in price in response to relatively small reductions in quantity supplied.

Why wasn't supply more responsive to changes in the price? Explanations other than poor weather and cyclical fluctuations have been offered. One theory lays the blame on Congress for allowing the Sugar Act to lapse. This allegation has little substance. The argument is that foreign suppliers diverted their sugar from the low priced U.S. market to the high priced world market because they had no 1975 quota to lose. The explanation is inconsistent with the facts. In 1974, foreign imports into the U.S. increased at twice the rate they had grown through all the years 1962-74 (see Chapter VI).

Another explanation lays the blame on the Cost of Living Council's (CLC) regulation of prices. There was a very large deficit in domestic sugar beet production in 1974. Representatives of the beet growers have attributed this shortfall to low prices received in 1971 and 1972 because of CLC regulations. In support of this argument, they cite beet sugar prices which were below those for refined cane sugar. Available price data do not support this explanation of the differences in sugar prices. As to the larger question, no definitive conclusions were possible.

There have also been allegations that sugar exporting countries formed an OPEC like cartel that restricted world sugar supplies. An attempt to negotiate a new International Sugar Agreement (including export restrictions) was made in 1973, but this attempt failed. No evidence was found of any other attempt to restrict production or exports, though an extensive investigation was not made.

The most noteworthy characteristic of the wholesale price structure for refined sugar is the use of a freight basing point system in each region (see Chapter VII). This system can and does introduce some distortions and inequities into the regional markets. While only tentative conclusions can be drawn using the available information, such distortions seem particularly noticeable in the Intermountain-Northwest region, where prices are higher than would be expected from the large number of beet processing plants located in the region. Similar distortions also seem to be present in other beet producing areas. A freight basing point system can also be used as a device to facilitate collusion on prices. These aspects of the industry deserves more intensive investigation.

Finally, the last chapter (VIII) examines performance in the sugar refining segment of the industry in terms of profitability, extent of suboptimal capacity, production efficiency and technological progressiveness. The profitability data leave much to be desired, but they do indicate that this was not an especially profitable industry between 1967 and 1975. Rates of return on stockholders' equity were generally below those for food and kindred products and for all manufacturing. There is some indication that beet processing is more profitable than cane refining, but the data here are particularly weak. Profits in 1974, however, were high by any standard. If correct, these profitability estimates may suggest that, in spite of the very high concentration in this industry, barriers to entry are not substantial.

There is no evidence that plants of suboptimal capacity are a problem in cane refining, but there are a large number of beet processing plants that appear to be inefficiently small. This may be due to acreage limitations imposed by the Sugar Act and/or the "participatory contracts" used by the beet growers and producers.

Despite the absence of major technological change in this century, both the cane and beet processing segments have exhibited rates of technological progress that exceed the rate for all manufacturing. However, the rate has declined in the 1970's. The production efficiency of these segments of the U.S. industry compares favorably with their counterparts in such other industrial countries as Canada and Sweden.

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I. Introduction

Refined sugar is obtained from two major raw agricultural products, sugar cane and sugar beets. Refined cane and beet sugars consist of the same chemical substance, sucrose. Thus, they are physically and chemically identical and are nearly perfect substitutes in the opinion of consumers. 1/

While the end product is the same, the production of refined sugar from sugar beets differs in both technology and organization from the production of cane sugar. Beet sugar is produced in a single process which occurs in plants located near the beet fields. These processing plants generally do not operate year round. They begin operations when the harvest begins and operate for about four or five months until the crop is completely processed. 2/

Cane sugar production involves two processes which usually occur in separate locations. The first of these is the grinding of sugar cane to produce raw sugar. Grinding mills are located near the cane fields and operate only seasonally. Raw sugar can be shipped economically and is traded internationally. The second stage of production is known as refining. Refineries use raw sugar as an input and produce refined sugar as an output. They generally operate all year, buying their raw sugar from various cane growing areas having different harvest seasons. 3/

1/ Some slight measure of product differentiation may exist in that some packages are labeled "pure cane sugar" while beet sugar is rarely identified as "pure beet sugar." This may be a residual from an earlier period when beet sugar seems to have been considered somewhat inferior by household users.

2/ In parts of California, sugar beets are harvested all year and the processing plants run all year. See the discussion in Appendix A.

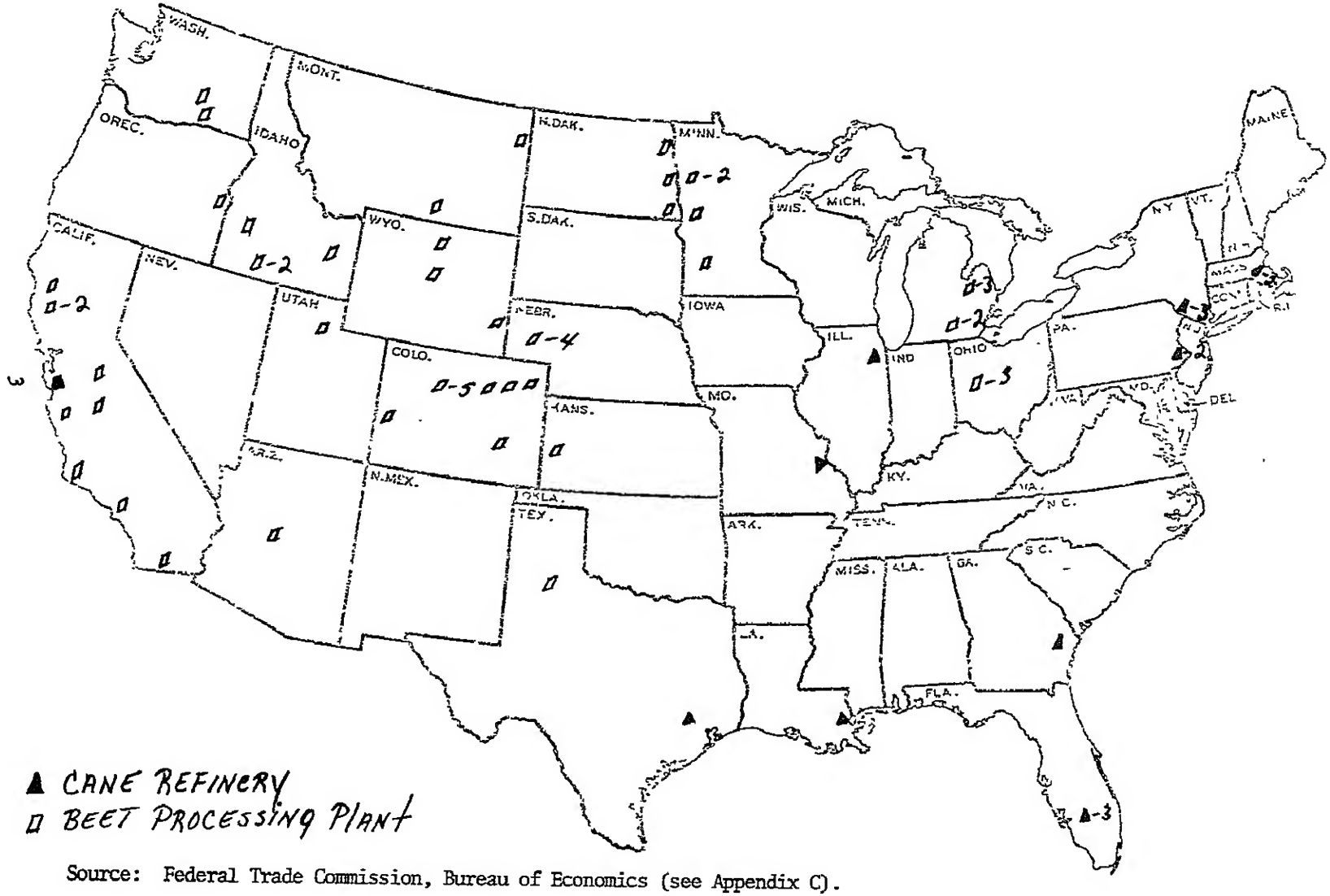
3/ For a more complete discussion of the technology of sugar production see Appendix A.

Figure I-1 shows the location of cane sugar refineries and beet sugar processing plants in the United States. It can be seen that cane refineries tend to be located at major ports. Such locations reduce the costs of obtaining raw sugar, particularly raw sugar imported from overseas, and of shipping refined sugar to customers. The necessity of locating near the beet fields explains the concentration of beet processing plants in the major sugar beet growing areas -- California, the Rocky Mountain States, and the Red River Valley of Minnesota and North Dakota. Because of a similar need to be near the sugar cane fields, the cane grinding mills, which are not shown on the figure, are located mainly in Florida, Louisiana, and Hawaii.

Table I-1 presents data on refined sugar deliveries by U.S. cane sugar refiners, beet sugar processors, and direct importers of refined sugar for the period 1964-74. Over this period, cane sugar filled approximately 70 percent of domestic refined sugar demand; beet sugar, approximately 30 percent. Total deliveries of refined sugar increased by about 16 percent over the period. The peak of about 11.4 million short tons, raw value, was reached in 1972 and again in 1973. 1/ Preliminary data for 1974 indicate a decline in total deliveries of about 2 percent from the peak. While cane refiners' deliveries grew by over 3 percent from 1973 to 1974, the deliveries of beet processors fell by about 14 percent over the same period. The wholesale price of refined sugar in the Northeast rose from an average of 14.07 cents per pound for 1973 to 34.35 cents per pound for 1974. The purpose of the present study is to illuminate the sources of these and other changes which have taken place in the U.S. refined sugar industry.

1/ Due to losses in the refining process, 107 pounds of raw cane sugar are required to produce 100 pounds of refined sugar. Hence, the conversion factor of 1.07 is used to convert refined sugar to its raw value equivalent.

Figure I-1: Location of Cane Sugar Refineries and Beet Sugar Processing Plants



Source: Federal Trade Commission, Bureau of Economics (see Appendix C).

Table I-1
U.S. Refined Sugar Deliveries
(in thousands of short tons, raw value)

Year	Distributors: U.S. Cane Refiners	Distributors: U.S. Beet Processors	Importers	Total
1964	6,698	2,700	236	9,634
1965	6,820	3,025	221	10,066
1966	7,145	3,024	199	10,368
1967	7,313	2,824	306	10,443
1968	7,705	3,085	229	11,019
1969	7,361	3,216	159	10,736
1970	7,658	3,569	154	11,381
1971	7,817	3,437	118	11,372
1972	7,838	3,510	93	11,441
1973	7,848	3,512	80	11,440
1974	8,121	3,025	59	11,205

Source: U.S. Department of Agriculture, Agricultural Stabilization and Conservation Service, Sugar Statistics and Sugar Reports, various issues.

II. The Demand for Refined Sugar

Consumption of refined sugar in the United States has risen steadily over the past century. As the data in Table II-1 show, total consumption in 1875 was 1.8 billion pounds. In 1973 total consumption was 21.4 billion pounds. This is more than a tenfold increase. The only periods showing a decline in total consumption were during World War II, when consumption was limited by government regulation, and in the early years of the Great Depression.

While total consumption has risen steadily, per capita consumption has remained essentially unchanged since 1925 or 1930. This is consistent with the findings reported by Fred Gray:

> "The effect of consumer incomes upon sugar consumption depends in large part on the level of income. When income levels are comparatively low, rising incomes are related to increasing sugar consumption. Viton and Pignalosa noted that for underdeveloped countries, sugar consumption rises as income rises, though the proportion of income spent on sugar declines. And per capita consumption reaches a maximum point at which further increases in income are not related to increased sugar consumption." 1/

Thus, increased consumption up to 1925 or 1930 was the result of both increasing population and increasing consumption per capita as a result of rising incomes. 2/ Since 1930 the increase in total consumption is mainly the result of increases in population.

1/ F. D. Gray, "Sweetner Consumption, Utilization, and Supply Patterns in the United States: Past Trends and Relationships, and Prospects for Target Years 1980 and 2000," (unpublished manuscript), p. 144. The reference to Viton and Pignalosa is to A. Viton and F. Pignalosa, Trends and Forces of World Sugar Consumption, Commodity Bulletin Series No. 32, Food and Agriculture Organization of the United Nations, Rome, Italy, 1961, p. 11.

2/ An additional influence may have been declining real prices of sugar during the period.

Table II-1
U.S. Sugar Consumption, 1875-1973

Year	Total Consumption (Million Pounds)	Per Capita Consumption (Pounds)
1875	1,816	40.3
1880	2,146	42.7
1890	3,329	52.8
1900	4,961	65.2
1910	6,967	75.4
1920	9,103	85.5
1925	12,081	104.3
1930	13,489	109.6
1935	12,356	97.1
1940	12,628	95.7
1945	9,790	73.9
1950	15,244	100.6
1955	16,020	96.3
1960	17,387	97.6
1965	18,776	96.6
1970	21,000	102.5
1973	21,404	102.0

Sources: U.S. Bureau of the Census, Historical Statistics of the United States and Statistical Abstract of the United States. Total consumption was estimated by multiplying per capita consumption by estimated population as of July 1 of the year in question.

Sugar is sold to both industrial and nonindustrial users. In 1973, shipments to industrial users were 143,822,173 hundredweights. This was 67 percent of the total shipments in that year. The beverage industry is the largest industrial user of sugar, accounting for 34 percent of industrial sales in 1973. Other major industrial buyers of sugar include: the bakery, cereal, and allied products industries, which accounted for 20 percent of industrial sales; the confectionery industry, which accounted for 14 percent; and canned, bottled, and frozen foods, jams, jellies, and preserves, which accounted for 14 percent. 1/

For the five-year period 1968-73, shipments to industrial users increased at a rate of about two percent per year. The beverage industry had the largest increase by industrial users with an increase of 22 percent during the five-year period. Other industries showing large percentage increases in usage were ice cream and other dairy products; canned, bottled, and frozen foods, jams, jellies, and preserves; and nonfood uses. 2/ Shipments to nonindustrial users decreased about one percent during the 1968-73 period. 3/ A major cause of this change may have been increases in per capita income. In addition to showing that increases in income do not increase total sugar consumption in affluent countries, Gray argues that such increases do cause changes in the form in which sugar is consumed. With increased affluence, a larger proportion of sugar is consumed in commercially prepared foods and soft drinks rather than being purchased in five- and ten-pound bags. 4/

Elasticity of Demand

In addition to understanding the effects of population and income on the consumption of sugar, it is also necessary to understand the effect of price changes on consumption. If the price increases, will

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1/ U.S. Department of Agriculture, Agricultural Stabilization and Conservation Service, Sugar Reports, No. 262, March, 1974, p. 17.

2/ U.S. Department of Agriculture, Agricultural Stabilization and Conservation Service, Sugar Statistics, Vol. I, Revised December, 1969, p. 66; and Sugar Reports, No. 262, March, 1974, p. 17.

3/ Ibid.

4/ Gray, pp. 144-50.

sales fall off dramatically as users buy a good substitute for the product? Or, will demand remain about the same because there are no alternative products which satisfy the same needs? Similarly, what will happen to the quantity of the product sold when the price of another product changes? Answering these questions is important for several reasons. The answers will assist in any attempt to understand trends in prices and sales. In addition, the industry's performance will depend in part on these conditions of demand. If there are many good substitutes for a product, the producers are less able to increase their profits by raising prices above the competitive level than they would be if no substitutes were available.

The existence of good substitutes for a product is reflected in the own price elasticity of demand for that product (hereafter referred to as elasticity of demand). The elasticity of demand measures the responsiveness of quantity demanded to a change (either up or down) in the price of a given product. More precisely, the elasticity of demand is equal to the percentage change in quantity resulting from a one percent change in price for the product in question. 1/ If a 10 percent increase in price causes a 15 percent decrease in quantity demanded, elasticity of demand equals 1.5. 2/ Since quantity demanded has decreased by a greater percentage than price has increased, elasticity of demand is greater than one and demand is said to be elastic. Demand is said to be inelastic when the elasticity of demand is less than one. Where few good substitutes exist for a given product, demand for that product is likely to be inelastic. If the price of that product increases, relatively few buyers will switch to the inferior substitutes available. On the other hand, where many good substitutes exist for a given product, demand is likely to be elastic. An increase in price will cause quantity demanded to decrease by a relatively large percentage because buyers will readily shift their purchases to available good substitutes.

1/ While this is normally a negative value since quantity will decrease (increase) with an increase (decrease) in price, the elasticity is conventionally expressed as a positive number.

2/ Thus, in the above example elasticity of demand is $-\frac{(.15)}{.10} = 1.5$.

In the case of sugar, only a few limited substitutes exist for both industrial and household uses. For industrial uses, the corn sweeteners, dextrose and corn syrup, are the major caloric sweetner substitutes for sugar. 1/ As indicated in Table II-2, corn sweeteners accounted for a significant and increasing percentage of total caloric sweetener use during the period 1957-67. However, the extent to which additional quantities of corn sweeteners can be substituted for sugar in the short run is limited by both physical and economic considerations. Due to the form in which dextrose and corn syrup are available, substitution for sugar in most uses is possible only up to a set percentage of total sweetener content. Also, the time and cost required to expand corn refining capacity limit the quantities of additional corn sweetener that can be produced in the short run. 2/

In some household and industrial uses, the noncaloric sweetener saccharin is a limited sugar substitute. While precise data on saccharin consumption are not readily available, rough estimates indicate that total supply from domestic production and imports will be 5 to 5.5 million pounds in 1974. The substitution of saccharin for sugar is limited by physical and esthetic considerations. Its low bulk makes it a poor substitute in products which are mostly sugar by weight. Its unpleasant aftertaste places a limit on consumer acceptance. 3/

The existence of only a few limited substitutes for sugar has relatively clear implications for the elasticity of demand for sugar. In response to an increase in the price of sugar, many users will have no alternative but to continue to purchase sugar. Hence, the decrease in the quantity of sugar demanded should be small relative to the increase in price. This implies that the demand for sugar is inelastic, with elasticity of demand probably closer to zero than to one. 4/

1/ Other caloric sweeteners are honey, maple syrup, and other syrups.

2/ F. D. Gray, "Outlook for Sweeteners Other than Sugar," (unpublished manuscript), pp. 3-5.

3/ Gray, "Outlook for Sweetners Other than Sugar," pp. 8-9.

4/ Another factor which affects elasticity of demand is the impact a change in price has on a consumer's real buying power. However, this factor will only be significant if a large percentage of a consumer's budget is spent on the good. At the relatively high average price of 1974, per capita expenditures on sugar were only about $35. This is only about one percent of per capita disposable income and is not large enough for price changes to generate a substantial "income effect."

Table II-2
Caloric Sweetener a/ Use, 1957-67.
(percent of total)

Year	Caloric Sweetener			
	Sugar	Dextrose	Corn Syrup	Total Non-sugar
1957	88.4	3.4	8.2	11.6
1958	87.8	3.8	8.4	12.2
1959	87.4	3.9	8.7	12.6
1960	87.1	3.9	9.0	12.9
1961	87.3	3.8	8.9	12.7
1962	86.4	4.0	9.6	13.6
1963	85.7	4.4	9.9	14.3
1964	84.4	4.4	11.2	15.6
1965	84.7	4.3	11.0	15.3
1966	84.9	4.1	11.0	15.1
1967	83.4	4.8	11.8	16.6

a/ Ignores small amounts of other caloric sweeteners, e.g., honey, maple syrup, and other syrups.

Source: R.A. Ballinger, A History of Sugar Marketing, U.S. Department of Agriculture, Economic Research Service, Agricultural Economic Report No. 197, p. 107.

A number of estimates have been made of the elasticity of demand for sugar at the aggregate level. The results of these studies give a rough indication of the order of magnitude of this elasticity. The estimates obtained range from 0.20 to 0.40 for various sets of data and time periods. 1/ Thus, in response to a 10 percent increase in the price of sugar, these estimates predict that the quantity of sugar demanded would decrease by from two to four percent. 2/

A further indication of the shortrun responsiveness of the quantity of sugar demanded to the price of sugar can be obtained from consideration of data for 1973-1974. Total distribution of sugar by primary distributors in the continental United States in 1973 was 11,538,357 short tons, raw value. 3/ Growth of the U.S. resident population from July 1, 1973, to July 1, 1974, was 0.73 percent. 4/ In order to maintain per capita consumption at the same level as in 1973, total sugar distribution would have had to grow by the same percentage to 11,622,587 short tons, raw value, in 1974. Actual 1974 distribution was 11,247,579 short tons, raw value. The quoted wholesale (gross) price of refined cane sugar in the Northeast rose from an average of 14.07 cents per pound in 1973 to 34.35 cents per pound in 1974. The 3.28 percent fall in quantity can be attributed in large part to the 83.77 percent increase in

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1/ See, F. D. Gray, "Sweetner Consumption, Utilization, and Supply Patterns in the United States," p. 155; and P. S. George and G. A. King, Consumer Demand for Food Commodities in the United States with Projection for 1980, Giannini Foundation Monograph Number 26, March 1971, California Agricultural Experiment Station, University of California, Berkley, pp. 46-51.

2/ Extended comment on the accuracy of these estimates is precluded by insufficient information. For example, levels of significance were not published with the estimates. However, it can be noted that the studies cited made no apparent allowance for simultaneous equation bias and employed nominal rather than real prices.

3/ Price and quantity data were obtained from the United States Department of Agriculture, Agricultural Stabilization and Conservation Service, Sugar Reports, No. 272, January 1975.

4/ Telephone interview with D. L. Kaplan, U.S. Department of Commerce.

price. 1/ The resulting rough estimate of the shortrun elasticity of demand for sugar is 0.04. While this estimate is substantially lower than the 0.20 to 0.40 estimates of the studies cited above, its crudeness should be taken into account. It is a rough estimate since changes in variables other than the price of sugar also tended to affect sugar consumption. The price of corn syrup on a dry basis rose from 8.53 cents per pound in 1973 to 13.21 cents per pound in 1974. Per capita disposable income in constant (1958) dollars fell from an annual rate of $2,952 in third quarter 1973 to $2,842 in third quarter 1974. 2/ Thus, the shortrun fall in sugar consumption due to the rise in the price of sugar is only roughly approximated by the estimate presented above.

Cross Elasticity of Demand

While elasticity of demand reflects the presence of good substitutes, cross elasticity of demand provides a measure of the closeness of specific substitutes. The cross elasticity of demand of product A with respect to product B is the percentage change in the quantity of A demanded caused by a one percent change in the price of B. If A and B are substitutes, the cross elasticity of demand of A with respect to B will be positive. That is, if the price of B rises, other things being equal, substitution of A for B by users should cause the quantity of A demanded to rise. If A and B are close substitutes, the cross elasticity of demand should be relatively large.

1/ Percentage changes were calculated from the average value over the two years.

2/ U.S. Department of Commerce, Bureau of Economic Analysis, Survey of Current Business, December 1974. These data are seasonally adjusted at annual rates. The responsiveness of quantity demanded to changes in income is measured by the income elasticity of demand, the ratio of the percentage change in quantity demanded to the percentage change in income. The income elasitcity of demand for sugar has been estimated to be between 0.03 and 0.18. See, Gray, "Sweetener Consumption, Utilization, and Supply Patterns in the Untied States," p. 155; and George and King, pp. 46-51.

It has already been pointed out that only a few substitutes for sugar exist. Also, with respect to each available substitute, physical, esthetic, and/or economic limits to the ability of that substitute to replace sugar were identified. These limits imply that in response to an increase in the price of sugar, or a decrease in the price of, say, corn syrup, users of sugar will be able to substitute only relatively small additional quantities of corn syrup for sugar. This implies that the cross elasticity of demand for sugar with respect to corn syrup should be positive, but probably relatively close to zero. The same should be true for the cross elasticity of demand for corn syrup with respect to sugar.

Available estimates of these cross elasticities give a rough indication of orders of magnitude. 1/ These estimates are:

Cross elasticity of demand for sugar with respect to corn syrup

$$= \frac{\text{percent change in quantity of sugar demanded}}{\text{percent change in price of corn syrup}}$$

$$= 0.05$$

and

Cross elasticity of demand for corn syrup with respect to sugar

$$= \frac{\text{percent change in quantity of corn syrup demanded}}{\text{percent change in price of sugar}}$$

$$= 0.13$$

The positive signs of these estimated elasticities are consistent with the prediction that corn syrup is a substitute for sugar. The size of these estimates is consistent with the limits in the ability of corn syrup to substitute for sugar. Thus, these estimates predict that a 10 percent rise in the price of sugar would increase the quantity of corn syrup demanded by little more than 1 percent. A 10 percent rise in the price of corn syrup would increase the quantity of sugar demanded by one-half of one percent.

1/ George and King, pp. 46-51. Cross elasticities between sugar and dextrose and sugar and saccharin were not presented.

III. Structure of the Sugar Refining Industry 1/

A. Concentration Data

One of the most commonly used measures of industry structure is the level of concentration within the industry. There has been some debate among economists concerning the proper measure to use in expressing the level of concentration; however, the most frequently used measures are the four-firm and eight-firm concentration ratios (C4 and C8). These ratios reflect the proportion of an industry's total output produced by the four and eight largest producers in the industry. The interpretation generally placed on these measures is that the closer the ratios approach 1.0 (that is, the larger the proportion of industry output accounted for by the four or eight largest firms), the greater becomes the probability that industry performance will deviate from the competitive norm. This deviation may be manifested by firms in the industry earning profits in excess of their opportunity cost of capital. Alternatively, the condition may be manifested in inefficient methods of operation which cause the cost of producing a good to be higher than necessary. Most economist accept this interpretation of concentration measures; 2/ nevertheless, they recognize that there can be reasons why it is not feasible to have a large number of small producers in an industry. Therefore, one must look beyond a high concentration ratio before drawing policy conclusions about the desirability of the structure of any given industry.

For a discussion of concentration to be meaningful, the products to be included in the industry and the geographic market must first be established. In relation to the products to be included in the sugar industry, current practices of the Bureau of the Census in computing separate concentration figures for refined cane sugar (Standard

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1/ For a discussion of the development of this structure, see *Appendix B: A Sketch of the Early Industrial History of Sugar Refining in the U.S.*

2/ Among the dissenters are Harold Demsetz, Yale Brozen, and J. Fred Weston.

Industrial Classification industry 2062) and refined beet sugar (SIC industry 2063) make little economic sense. As Robert R. Nathan Associates, Inc., observe in their study of the sugar refining industry: "Refined sugar, whether it comes from cane or from beets is $C_{12}H_{22}O_{11}$, a completely fungible commodity." 1/

Recent evidence suggests that sugar is not normally traded in a single national market. Leonard Weiss has estimated that 90 percent of all refined sugar is shipped 921 miles or less. 2/ Since the distance from the east coast to the west is roughly 3,000 miles and the distance from the Canadian border to the Mexican border is about 1,200 miles, a product shipped less than 1,000 miles is unlikely to trade in a single national market. It is much more likely that the commodity trades in a series of regional markets. Weiss' estimates are based on actual data on shipments of refined sugar collected for the 1963 Census of Transportation. Therefore, these should be more reliable than previous subjective judgments about the size of the market which have resulted in classifying the market for sugar as national in scope. 3/ Additional

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1/ Cane Sugar Refining in the United States: Its Economic Importance, study by Robert R. Nathan Associates, Inc., for the United States Cane Sugar Refiners' Association, 1971, p. 34.

2/ Leonard W. Weiss, "The Geographic Size of Markets in Manufacturing," The Review of Economics and Statistics, 54 (August 1972), pp. 245-57.

3/ See, e.g., Carl Kaysen and Donald F. Turner, Antitrust Policy: An Economic and Legal Analysis, Harvard University Press, 1959; and Concentration Ratios in Manufacturing Industry, 1958 and 1963.

support for the existence of regional markets is found in the relationship between the cost of transporting a ton of sugar and the value of the sugar. These data also suggest that sugar is not traded in a single national market. 1/

Determining the geographic bounds of regional markets is not an easy task. What is desired is to find areas within each of which consumers and industrial users buy most of their sugar from firms located in the area and sugar producers in the area sell most of their output to users located in the area. It may be feasible to find regions which satisfy these conditions when all of the users and producers in one region are widely separated from the users and producers in another area. Such regions may also be found where legal barriers, such as quotas or prohibitive tariffs, prevent producers in one region from selling in another. If neither of these conditions holds, attempts to draw lines between regions are apt to be somewhat arbitrary. And, these conditions do not hold when the various regions are just different parts of the United States.

Accordingly, it is not possible to get distinct and separate regional markets within which refined sugar is sold. There are, however, seven major regions which are generally used in setting and reporting wholesale prices for refined sugar. The price paid by two buyers located in the same region or subregion who are buying from the same supplier of sugar will differ only to the extent that the charges for delivering the sugar to their locations differ. 2/ If the two buyers are located in different regions, the price to which the freight charges are added may differ as well as the freight charges. Thus, these seven pricing areas--which are shown in Figure III-1--make reasonably good regional markets for computing concentration. 3/ 4/

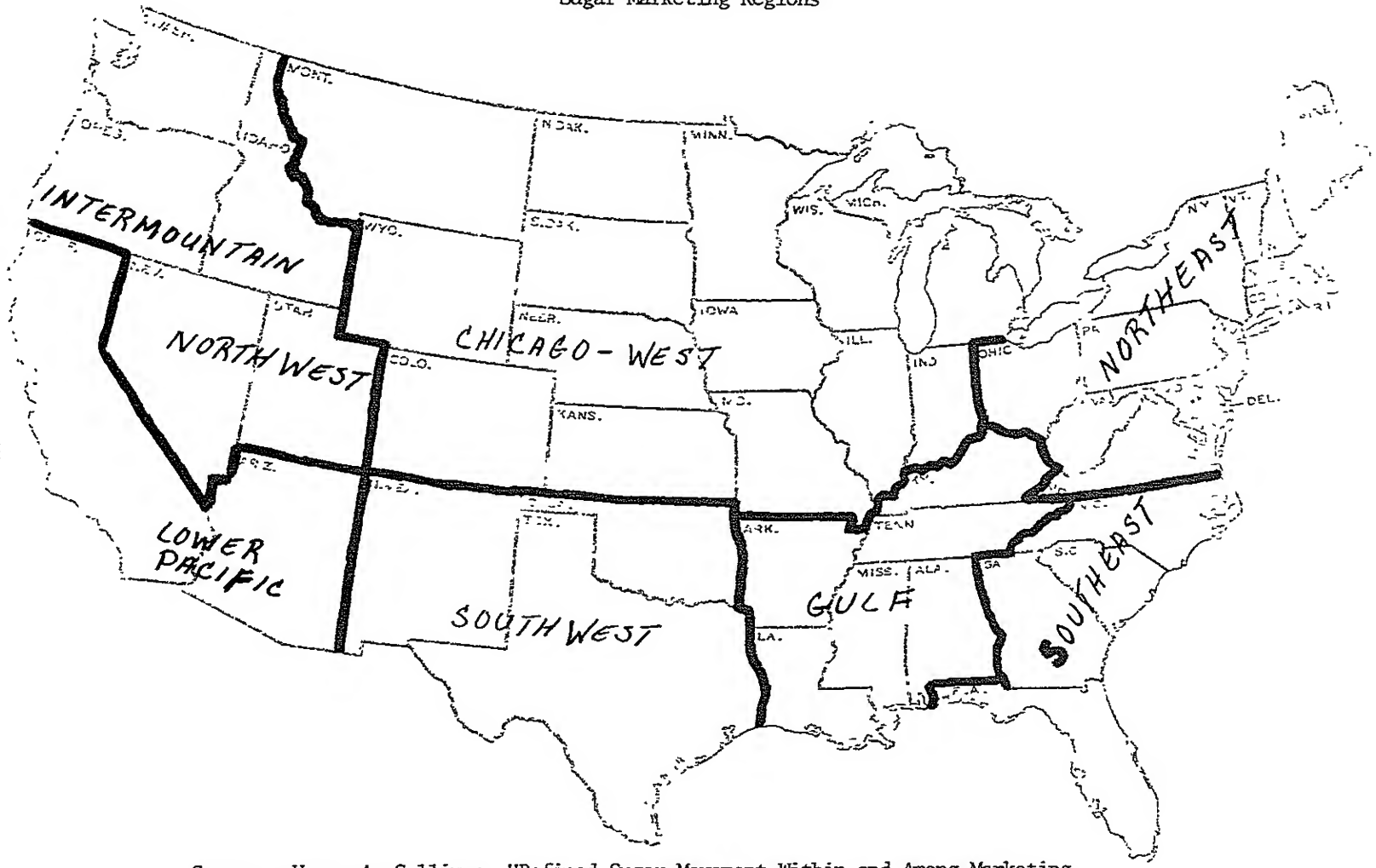
1/ See, F. M. Scherer, et al., The Economics of Multi-Plant Operation: An International Comparisons Study, Harvard University Press, forthcoming.

2/ See Chapter VII for a complete discussion of the wholesale pricing of refined sugar, including a discussion of submarkets in the Lower Pacific and Northeast regions.

3/ The regions shown in the figure and used in this chapter are drawn directly from Harry A. Sullivan, "Refined Sugar Movement Within and Among Marketing Territories," Sugar Reports, No. 240, May 1972.

4/ The fact that prices may differ among subregions in a pricing region might suggest that the subregions should be used for computation of concentration. This was not done here for several reasons. First of all, the appearance of the submarkets is a fairly recent occurrence and their significance is not clear. Second, the fact that sugar can economically be shipped as far as 900 miles suggests that the submarkets may not really be separate markets in the economic sense. Finally, data on interregional shipments are only available for the seven major regions. Thus, it would not be possible to compute the more-meaningful consumption concentration figures for the various submarkets.

Figure III-1
Sugar Marketing Regions



Source: Harry A. Sullivan, "Refined Sugar Movement Within and Among Marketing Territories," Sugar Reports, No. 240 (May, 1972).

Table III-1
Inter-regional Shipments of Refined Sugar, 1970

Marketing Region	Percent of Production Exported Out of Region	Percent of Consumption Imported from Outside Region
Northeast	2.3	10.2
Southeast	3.4	35.6
Gulf	62.4	5.5
Southwest	1.3	35.8
Lower Pacific	25.4	2.0
Intermountain Northwest	71.1	29.2
Chicago-West	14.8	55.2

Source: Harry A. Sullivan, "Refined Sugar Movement Within and Among Marketing Territories," Sugar Reports, No. 240, May 1972.

The major shortcoming of these pricing areas as regional markets is that there are substantial shipments between regions with some regions exporting as much as 70 percent of their production and others importing as much as 55 percent of the amount consumed. 1/ In the concentration figures which follow, adjustments have been made for shipments from one region to another, so that the reported concentration figures will reflect the concentration of sugar sold in a given marketing area.

Four- and eight-firm concentration ratios for the consumption of refined sugar in each of these marketing regions are shown in Table III-2. The concentration ratios are based on estimates of 1972 sales by each cane sugar refinery or beet processor and the knowledge of inter-regional shipment patterns. 2/ Sugar is generally sold in a highly concentrated market. With the exception of the Chicago-West market, the four largest sellers in a region make 80 percent or more of the total regional sales. On the Pacific Coast the four-largest sellers make over 90 percent of the sales. The reason for lower concentration in the Chicago-West region (C4 = 52.7 percent) is found in the high level of sugar shipments into the region. Over 55 percent of the area's consumption is satisfied by producers located in other regions. Substantial shipments come from the Intermountain Northwest, Lower Pacific, Southwest, and Gulf regions. Thus, producers located in each of these regions affect market conditions in the Chicago-West area.

On a national basis, Amstar is the largest producer of refined sugar, with total 1972 sugar sales estimated at $699.6 million. It alone accounts for more than 25 percent of the sugar sold in this country and it is the only firm that manufactures both cane and beet sugar. Amstar ranks among the four largest sellers in each of the seven marketing regions. It is the largest marketer in the Northeast and Gulf regions. In the Northeast it accounts for 50 percent of sales. In the Gulf area, Amstar's market share is about one-third. In the Lower Pacific region, where Amstar has its beet sugar operations, the company is the second largest supplier of sugar with a market share slightly larger than one-fourth.

1/ Table III-1 shows the percentage of production exported and the percentage of consumption imported for each of the seven regions. All figures are for 1970.

2/ For the estimates of individual plant sales and the techniques used in making them, see Appendix C. This appendix also describes the techniques used in estimating sales--in contrast to production--within a region.

Table III-2
Concentration of Refined Sugar Sales
by Marketing Region, 1972
(expressed as a percentage of total regional sales)

Marketing Region	Four-Firms	Eight-Firms
Northeast	80.8	96.0
Southeast	85.8	97.4
Gulf	79.7	97.5
Southwest	80.0	91.9
Lower Pacific	95.3	100.0
Intermountain Northwest	93.5	100.0
Chicago-West	52.7	79.0

Source: Federal Trade Commission, Bureau of Economics (see Appendix C).

The second largest marketer of sugar nationally is California and Hawaiian Sugar. This cooperative has only one sugar refinery which is located in Crockett, California, near San Francisco. 1/ This refinery is the world's largest. C & H's sales in the Lower Pacific region account for 50 percent of sugar sales in that region. The largest producer of beet sugar and the third largest producer over-all is Great Western United. Most of the company's processing plants are located in the Midwest and the company is the largest marketer of sugar in the Chicago-West marketing region. It accounts for approximately 20 percent of the sugar sales in that area.

A level of concentration as high as is found in the refined sugar industry might normally be taken as an indicator of a noncompetitive industry. Since four firms make 80 percent or more of the sales in any region, it should be relatively easy for the industry to set a price above the competitive level and thereby earn high profits. Are such concerns warranted in the sugar industry? If not, why not? As was pointed out before, the marketing regions in the sugar industry are not self-contained. There is a high level of inter-regional shipments. Additionally, Weiss has estimated that it is economically feasible to ship sugar at least 900 miles. The feasibility of inter-regional shipments would seem to reduce substantially the market power implied by the high levels of concentration. To illustrate, consider what would happen if producers in the Southeast region attempted to raise their prices by a substantial amount. Such a price change would make it more profitable for producers located in the Gulf and Northeast regions to sell sugar in the Southeast. This would cause these producers to market more sugar in the Southeast. If the price rise were large enough, it would become profitable to ship sugar from the refineries in Houston, and possibly even Chicago. This would increase the supply of sugar in the Southeast region, which would tend to force the price of sugar back toward the competitive level.

Of course, it is possible that some or all producers in the adjoining regions would choose not to ship into a region where price had been elevated above cost. Certainly, no added shipments would occur if the firms operating in the neighboring regions were the same firms

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1/ The company also has a small refinery in Hawaii which mainly supplies the sugar needs of the Hawaiian Islands.

that were earning the supranormal profits. This suggests that it is better to have different firms operating in different regions. Even if the same firms operate in all regions it is better to have different firms being largest in different regions. If the same four or six firms account for 80 or 90 percent of output in all regions, these four or six firms can largely determine price in any or all of the regional markets. Since they compete in all of the markets, it will be easier for one firm to learn how the others will react if it takes a certain action. Such familiarity will make it easier for schemes which restrict output and raise price to be originated and to last.

An additional desirable possibility exists if different firms operate in different regions. This is the possibility of entry. Even if a firm can not ship sugar from an existing plant into a region where price is inflated, that firm's reaction must be considered by firms in the region when they contemplate raising price. It would probably be easier for an existing sugar producer to build a plant in a different region and begin operating there than it would be for a new or existing firm which lacks previous experience in the production and marketing of sugar. 1/

Do the same firms occupy the leading positions in all the marketing regions? The discussion of Amstar, California and Hawaiian, and Great Western United showed each of them to be the leading producer in one or more regions. Table III-3 shows the four largest marketers of sugar in each region, based on the estimation of sales by region discussed previously. These data show that, with the exception of Amstar, no firm is the largest producer in more than one region. Amstar is the largest producer in two regions and is among the four largest in every region. Altogether, this suggests that regional concentration levels in the 80 percent range do not carry with them as much market power as they might. Certainly, there is less cause for alarm than there would be in an industry with national concentration at this high level.

1/ Of course, if there are barriers to entry into the region which are present even for an existing producer--such as the inability to get enough raw product allocated to a new plant to operate it efficiently, the need to consider the reaction of potential entrants is reduced. (See the discussion of entry barriers at p. 31, below.)

Table III-3
Four Largest Sugar Marketers in Each
Marketing Region, 1972
(In order of decreasing regional sales)

Region
Northeast
Amstar
National Sugar Refining Co.
CPC International
United Brands
Southeast
Savannah Foods and Industries
Amstar
Borden, Inc.
Glades County Sugars Growers
Gulf
Amstar
Southern Industries
Borden, Inc.
J. Aron and Co.
Chicago-West
Great Western United
American Crystal Sugar Co.
Amalgamated Sugar Co.
Amstar
Southwest
Imperial Sugar Co.
Holly Sugar Corp.
Amstar
Great Western United
Intermountain-Northwest
Amalgamated Sugar Co.
Utah-Idaho Sugar Co.
California and Hawaiian Sugar
Amstar

Table III-3 (continued)

Region
Lower Pacific
California and Hawaiian Sugar
Amstar
Holly Sugar Corp.
Consolidated Foods

Source: Federal Trade Commission, Bureau of Economics (see Appendix C).

Next, consider the historical trend of concentration in the sugar industry. Has concentration risen in the last few years or has it always been high? The answer to this question is complicated by the fact that the Bureau of the Census only provides separate concentration data for refined beet sugar and refined cane sugar. The published concentration figures assume the market is national in scope. Hence, the only historical comparison possible is to compute these two measures from the sales estimates developed here and to compare these data with earlier Census Bureau estimates. The data for this comparison will be found in Table III-4. A quick perusal of those data suggests that there have been no major changes in concentration in the beet sugar industry over the past 40 years. Although the data for refined cane sugar go back only to 1963, they also provide no evidence of substantial changes in concentration.

New Entry and Changes in Plant Operations

Until the last year or so there appears to have been remarkably little entry into the refined sugar industry by the construction of new capacity. During the 1960's and 1970's there were several cases of firms entering the industry by buying firms or parts of firms already producing refined sugar. However, except for the successful entry of a cane refiner located in Florida in the early 1960's and an abortive entry attempt by a Maine firm, there had been no entry by construction of new capacity since 1936 when American Molasses Company, the precursor of SuCrest, entered the industry by building a new refinery in Brooklyn, N.Y. 1/

During 1974 two firms entered the refined sugar industry by building new sugar beet processing plants. Another firm is scheduled to enter the industry in 1975, also by building a beet processing facility. All three of these plants are owned by grower cooperatives and are located in the States of Minnesota and North Dakota. The two cooperatives beginning production in 1974 were the Red River Valley

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1/ Telephone conversation with an official of SuCrest Corporation, February 14, 1975.

Table III-4
Refined Cane and Beet Sugar Concentration
on a National Level, 1935-1972
(Expressed as percentages)

Year	Cane Sugar C4	Cane Sugar C8	Beet Sugar C4	Beet Sugar C8
1935			68	89
1947			68	94
1954			66	96
1958			64	94
1963	63	83	66	97
1966	63	87	68	97
1967	59	82	66	96
1970	59	86	65	(D)
1972	60	83	66	97

(D) - Census Bureau did not publish this number because it would have disclosed information about individual companies.

Sources: See U.S. Bureau of the Census, Annual Survey of Manufactures: 1970; Value-of-Shipment Concentration Ratios, 1972, for 1935-70 data. See Appendix C for derivation of 1972 figures.

Cooperative and Minn-Dak Farmers Coop. The Red River Valley plant is located in Hillsboro, N. Dak., and has a daily slicing capacity of 5,000 tons of beets. This plant, which cost in excess of $30 million, is expected to produce 1.5 million hundredweight of refined sugar per year. The plant will process sugar beets grown on 50,000 acres, at least 30,000 of which have not previously been under sugar beet cultivation. 1/ The plant constructed by Minn-Dak began operations in November of 1974 and also has a slicing capacity of 5,000 tons of beets per day. This plant is located in Wahpeton, N. Dak. 2/

Southern Minnesota Beet Sugar Cooperative is currently constructing a plant which is expected to be operational by the time this year's crop of sugar beets is harvested. The plant is located in Renville, Minn., about 100 miles east of Minneapolis-St. Paul. It has a slicing capacity of 6,500 tons of beets per day and is expected to produce 2 million hundredweight of refined sugar per year. The beets to be processed in this plant will largely come from experienced beet farmers whose beets were previously sold to American Crystal Sugar Co. and were processed in mills located in Chaska, Minn., and Mason City, Iowa. 3/ Those plants were closed in 1971 and 1973, respectively.

During the 1960's one firm successfully entered the industry by building new facilities. This was the Glades County Sugar Growers Cooperative, which began operations in 1961. 4/ In addition to producing refined sugar, this facility, located in Moore Haven, Fla.,

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1/ Statement of William G. Hejl, Vice President, Red River Valley Cooperative, Inc. before House of Representatives, Committee on Agriculture, Hearings-on Sugar Act Extension 1974, pp. 57-60.

2/ Telephone conversation with an official of Minn-Dak Farmers Coop, February 19, 1975.

3/ Telephone conversation with an official of Southern Minnesota Beet Sugar Cooperative, February 19, 1975.

4/ Telephone conversation with an official of Glades County Sugar Growers Cooperative.

is engaged in the grinding of sugar cane to produce raw sugar. 1/ The entry of Glades County Sugar Growers occurred during a period of substantial expansion in sugar cane growing in the State of Florida. In the 1959-60 crop year, only 14 farms in Florida grew sugar cane. The total acreage under cultivation was 47,100 acres. By the 1964-65 crop year, 182 farms grew 222,900 acres of sugar cane. 2/

Also during the 1960's an attempt at entry was made by Maine Sugar Industries, Inc., located in Easton, Me. The effort was short-lived. The firm was formed in 1965 and built a beet processing plant which began operation in January, 1967. Operations were suspended in 1969. During its three years of production, the company lost a total of $10,557,000. The major problem appears to have been the firm's inability to get enough sugar beets to operate the plant efficiently. While Maine had been allocated 30,000 acres of sugar beets under the Sugar Act, the acreage planted reached a maximum of 25,000 acres in 1968 and declined to 12,500 acres in 1969, 3/ as farmers in the region did not show much interest in growing beets. The State of Maine foreclosed the plant in 1971 and is currently attempting to sell it. 4/ 5/

In the last ten years, four firms have entered the sugar industry by buying firms or parts of firms already engaged in sugar production. In all four cases the facilities involved were cane sugar refineries.

1/ Producing refined cane sugar from sugar cane consists of two steps: the grinding of sugar cane and the refining of raw sugar. These two operations are usually done at separate locations.

2/ U.S. Department of Agriculture, Agricultural Stabilization and Conservation Service, Sugar Statistics and Related Data, Vol. II, Revised February 1969, p. 49.

3/ U.S. Department of Agriculture, Agricultural Stabilization and Conservation Service, Sugar Reports, No. 225, February 1971, p. 47.

4/ Telephone conversation with Mr. Lloyd Allen of the Maine Guarantee Authority, February 13, 1975.

5/ A similar shortage of beets seems to have plagued an earlier attempt to produce beet sugar in Maine. The first beet factory on the Atlantic coast was built in Portland, Me., in 1876. The company failed four years later because of a lack of beets. (Jack T. Turner, Marketing of Sugar, Indiana University, School of Business, Bureau of Economics, Research Study No. 38, Richard D. Irwin, Inc., 1958, p. 10.)

The most recent of these was the purchase of the sugar operations of J. Aron and Co. by Archer, Daniels, Midland Co. This purchase took place in July 1973, and marked Archer, Daniels, Midland's entry into both the grinding and refining of cane sugar. In April 1971, Borden, Inc., acquired North American Sugar Industries. North American Sugar and its subsidiaries operated three sugar refineries which are still maintained by Borden. During the 1960's two firms entered the industry via merger. In 1968 the Jim Walter Corp. completed acquisition of the South Coast Corporation which owned a sugar refinery in Mathews, La. Walter had held a majority interest in South Coast since August 1964. The other entrant by merger during the 1960's was Southern Industries Corporation, which acquired Godchaux-Henderson Sugar Co. in June 1966.

Within the last two years, three companies have stopped producing refined sugar. The first of these was J. Aron and Company, whose sale of its sugar operations to Archer, Daniels, Midland in July 1973 was discussed above. Similarly, United Brands left the sugar industry by selling its refinery. The buyer was SuCrest, an already established sugar producer. This sale took place in April 1974. The last firm exiting the sugar industry was Pepsico, which ceased operations at its refinery in Long Island City, N.Y., in July 1974. That refinery is now being dismantled.

There have also been a number of beet processing plants which have been closed in the last few years. The closing of these plants has not resulted in exit from the industry as the firms involved have other plants which have remained in operation. The most recent closing was that of the American Crystal Sugar Company's plant in Mason City, Iowa. This facility, which had a daily slicing capacity of 2400 tons of beets, was closed in February 1973. Also closed between 1971 and March 1975 were four other beet plants. These plants appear to be the smaller and older plants which were no longer economical to operate.

Another recent change in the sugar industry was the reorganization of American Crystal Sugar Co. 1/ Prior to 1973 the company was a

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1/ A similar reorganization of the sugar operations of Great Western United was under consideration for a while. This plan was defeated, however, by stockholders and debenture holders of Great Western United in September 1974. (Moody's Industrial News Reports, October 4, 1974, p. 2463.)

profitmaking firm incorporated in the State of New Jersey. Today the firm is a cooperative owned by sugar beet farmers in the Red River Valley. High returns to farmers growing sugar beets coupled with low returns to firms processing the beets appear to be the motivating force behind this reorganization. Because of low returns from processing, the old American Crystal Sugar was not interested in expanding its facilities. In fact, the firm had closed two of its plants in the prior three years. However, sugar beets are the best cash crop for farmers in the Red River Valley and the farmers were interested in expanding their output. This could only be done by expanding processing capacity. In order to get this expanded capacity the farmers took over the processing business. 1/ American Crystal is currently constructing a new plant with a slicing capacity of 4,500 tons per day. This plant, located alongside an existing plant in East Grand Forks, Minn., will be operational by January 1976. Additional modernization and expansion is planned for the company's existing plants. These building plans will increase American Crystal's capacity by 44 percent by the time the 1976 crop is harvested. 2/

It is natural to inquire at this point about the effect these plant changes have had on the concentration levels discussed before. This matter cannot be answered with any precision. The new plants being built in Minnesota and North Dakota represent almost a 30 percent expansion of capacity in the Chicago-West marketing region. Such a substantial change will almost inevitably affect the shipment of sugar into and out of the region which will in turn affect concentration in Chicago-West and other regions. However, ignoring any changes in interregional shipments, the increased capacity in the Chicago-West region would cause four-firm concentration there to drop by about two percentage points to about 50 percent. Any other major change would be found in the Northeast region, where SuCrest took over the refinery owned by United Brands and where Pepsico closed its refinery. The approximate impact of these changes would be to increase four-firm concentration in the Northeast region from about 81 percent to nearly 89.5 percent.

1/ Telephone conversation with an official of American Crystal Sugar, February 20, 1975.

2/ Ibid.

Barriers to Entry

Some general statements can be made about the conditions which a firm would face if it wished to begin producing refined sugar. Along with the concentration of producers in the industry, the ease or difficulty with which entry into an industry can occur will affect the performance of the industry. If entry is easy, existing producers cannot raise their prices much above the competitive level without attracting new firms into the industry. The presence of new firms will tend to increase the total output of the industry and thereby decrease prices. Thus, unless there is something to keep new firms from entering an industry, prices in excess of cost cannot be maintained long even though the industry is highly concentrated.

There is a fair amount of evidence suggesting that a sugar beet processing plant must be able to slice at least 4,000 to 5,000 tons of beets per day in order to operate efficiently. The smallest of the four plants recently completed or currently being built in Minnesota and North Dakota has a capacity of 4,500 tons per day. A recent study of the beet sugar industry in this country estimates 4,500 tons per day as the minimum efficient plant size. 1/ A slightly smaller estimate of minimum optimal size is obtained from the 1971 Annual Report of Utah-Idaho Sugar Company. In this report the company announced the closing of its plant in West Jordan, Utah, suggesting that an efficient plant would have to be at least twice the size of the West Jordan plant, which had a capacity of 1700 tons per day.

What does this minimum efficient size imply for a firm considering entry into beet processing? First, it should be noted that a firm building a single plant of minimum efficient scale would account for three to six percent of the refined sugar--both cane and beet--produced in the average marketing region. Since the demand for sugar is highly inelastic, 2/ a four percent increase in the amount of sugar being marketed in one region would cause a significant decrease in price. Assuming the elasticity of demand for sugar is 0.4--the largest estimate

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1/ R. A. Young, An Economic Study of the Eastern Beet Sugar Industry, unpublished Ph.D. dissertation, Michigan State University 1965.

2/ See, Chapter II.

of elasticity reported in Chapter II, a four percent increase in sugar marketed would cause a 10 percent fall in price. This is the impact that a new entrant would have if the new firm's output was sold in a single region and existing firms maintained their output. Given this situation, existing producers can charge prices moderately above cost without attracting new entry. 1/ It is likely that a new entrant would not sell his entire output in a single region, and therefore, the impact on price would be less. Additionally, if the demand for sugar is growing over time, the impact of the new entrant would be reduced. In total, the minimum efficient size of plant would seem to be a moderate barrier to entry into the industry. This may provide enough protection for existing producers to earn some supranormal profits. However, very high profits will still attract new firms into the industry.

One of the new beet processors has estimated that it would cost more than $30 million to construct their plant. 2/ While this is a large amount of capital to raise, it is not large relative to the investments that must be made to build a minimum efficient size plant in many other industries. F. M. Scherer suggests that entry into the brewing, cigarette, petroleum, cement, steel, and bearing industries would each cost more than $30 million. At the other extreme, the shoe industry could be entered for a mere $1 million. 3/

The final problem involved in setting up a new sugar beet processing operation is obtaining the beets. The Red River Valley Cooperative has estimated that its new plant will need 50,000 acres of sugar beets to keep it operating efficiently. 4/ This may be the largest hurdle to be overcome in entering the industry. Certainly, during the period that the Sugar Act was effective, there is evidence that there was a problem in getting a large enough acreage allotment to operate an efficient plant. William Hejl, of Red River Valley, has stated that his cooperative was allocated the maximum acreage that the Secretary of Agriculture

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1/ This, of course, does not imply that high prices will not result in increased sales by firms located in other regions.
2/ Testimony of William G. Hejl, p. 58.
3/ Scherer, et al., Appendix Table 3.7.
4/ Testimony of William G. Hejl, pp. 57, 59.

believed was authorized under the Sugar Act. This acreage, however, was sufficient to grow only about two-thirds of the beets needed for capacity operation of the plant. Mr. Hejl continued:

> "If we had had to depend on the acreage allocation obtained under the present Sugar Act and had not had the clear prospect of being able to take additional acreage up to the factory's full capacity, we could not have obtained financing and the factory would not have been built. It was only because of failure of the beet area to produce its quota and provide needed carry-over inventory, that we were able to go ahead."

Thus, it is only because there was excess capacity in the existing allotment for the area that Red River Valley was able to build this new plant. 1/

Data on the minimum efficient size of a cane sugar refinery are not as readily available as those for beet processing facilities. The only indication available is that the three refineries opened in the 1960's had daily raw sugar melting capacities of 350, 420, and 900 thousand kilograms per day. The smallest of these refineries was opened at Belle Glade, Florida in 1965 by the North American Sugar Refining Company. Purchased by Borden, Inc. in 1971, it produces only liquid sugar. Glades County Sugar Growers opened the 420 thousand kilogram refinery at Moore Haven, Florida in 1961. This refinery produces only granulated sugar. Both of these refineries were originally built as a part of integrated cane growing, grinding, and refining operations. Borden sold off the growing land and grinding equipment in 1971 and has operated the Belle Glade refinery using purchased Florida raw sugar since that time. 2/ Glades County Sugar Growers continues to run an integrated operation, with refining capacity expected to be expanded to approximately 540 thousand kilograms per day in the 1975 crop year. 3/ Amstar opened the 900 thousand kilogram refinery at Boston in 1960. It does not produce brown sugar.

These events suggest that successful entry into the manufacture of either refined granulated or liquid sugar products is possible at a scale of about 500 thousand kilograms per day. 4/ A plant of this size would account for approximately five percent of total sugar produced in the average marketing region.

1/ Testimony of William G. Hejl, p. 59.
2/ Telephone conversation with an official of Borden, Inc.
3/ Telephone conversation with an official of Glades County Sugar Growers.
4/ According to Census of Manufactures figures, these products account for over 90 percent of total 1972 refined sugar shipments.

What do these minimum efficient size estimates imply as to the necessary structure of the industry? Is the present highly concentrated structure necessary to achieve economies of scale in production? On the basis of the evidence presented above, there appears to be no technological reason for present high concentration levels. Since an efficient beet processing plant or a granulated or liquid cane sugar refinery accounts for only five percent of the average region's output, there is room for twenty such plants in that region, all of them efficient. 1/ Any economies to be realized by operating more than one plant seem small or nonexistent. 2/ All of the new entrants in the recent past operate only a single plant. This is true for Glades County Sugar Growers, which has been in business for over a decade, as well as for firms entering during the last two years. Thus, the available evidence suggests that it would be possible to have efficient production with regional concentration levels significantly less than those which now prevail.

1/ From data available for this study, it is not known whether an efficient cane refinery which produces a full line of refined sugars (i.e., granulated, powdered, liquid, and brown) must be larger than these minimum efficient size estimates and, if so, by how much. However, powdered and brown sugar comprised less than seven percent of total refined sugar shipments in 1972. Thus, even if producing a full line requires a larger size, relatively few such plants could probably supply the demand for powdered and brown sugars.

2/ There may be some such economies from operation of several beet processing plants. If such plants are not too far apart, plant capacity utilization can be insulated from fluctuations in local beet harvests by shipment of beets from surplus to deficit areas. (This argument was advanced by officials of Amstar, Corp.). However, external transactions through a market seem to be a good substitute for such intra-company transfers.

IV. Buyer Concentration

In analyzing the performance of an industry, consideration should be given to the structural characteristics of sectors that purchase the output of that industry. It is of interest to know whether output is sold primarily to household or industrial users. If industrial use is a large fraction of total use, it is important to determine whether purchases are made by a large number of relatively small buyers, or by a few large ones.

The household-industrial distinction is significant because it is frequently not economical for household users to acquire expert knowledge of the wide range of products they purchase. On the other hand, industrial users generally employ professional buyers who are highly knowledgeable of the relatively few products they purchase. 1/ The result of this difference is generally manifested in the extent to which advertising and other promotional activities are engaged in by the selling industry. An industry that sells primarily to consumers is more likely, other things being equal, to engage in heavy advertising and/or other promotional expenditures. An industry dealing primarily with professional buyers generally finds such promotional activity ineffective. With the exception of such factual information as specifications, professional buyers usually give little weight to advertising appeals in their decisionmaking process.

Given high seller concentration, the number and size of buyers is of significance in determining the respective bargaining power of the two groups. A few large buyers can play off one seller against another. Other things being equal, the result will generally be lower prices and seller profits than if many small buyers were facing a few large sellers. 2/ Such an exercise of buying power is particularly effective if the large buyers are also highly knowledgeable concerning the product being sold.

1/ To some extent knowledgeable wholesalers can engage in informed buying on behalf of household consumers. However the convergence of interests between these independent economic agents is likely to be smaller than that within a single industrial firm.

2/ See Douglas Brooks, Market Structure and Seller Profitability: The Impact of Buyer Concentration, San Diego State University Press, 1973.

Refined sugar is sold through brokers to industrial users, directly to industrial users, and to wholesalers, retailers, and other dealers for resale for household use. Industrial purchases accounted for approximately two-thirds of total sugar use, while household consumption represented nearly all of the remaining one-third in 1973. 1/

As was argued above, the importance of industrial use implies that little promotional expenditure will be made by refined sugar manufacturers. In fact, their advertising expenditures were only 0.38 percent of their total sales in 1967. In contrast, leading industrial users of sugar, whose products are sold primarily for household consumption, had advertising expenditures ranging from 1.6 to 6.4 percent of sales. 2/

In order to determine the importance of buying power in the market for refined sugar, several sources must be consulted. The shortcomings of some of these sources and the inevitable definitional differences which exist among any group of data sources make exact measurement of actual sugar purchases by firms impossible. However, the available data do permit estimation of the shares of total sugar sales purchased by the leading four (B4) and the leading eight (B8) industrial users. By analogy, with familiar measures of seller concentration, these two measures of buyer concentration reflect the power of buyers over price. Given the high level of seller concentration found in the sugar industry, as B4 and B8 approach unity, the ability of buyers to obtain price discounts should increase. Thus, the elevation of selling industry profits above the competitive cost of capital should be reduced. Separate estimates of buyer concentration will be made for industrial and non-industrial users.

In order to estimate industrial user concentration, data were collected on sugar purchases and sugar purchases as a percentage of using industry sales for the leading sugar purchasing industries. These data were obtained from the 1967 U.S. Department of Commerce, Input-Output table and are presented in Table IV-1. The industries included

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1/ U.S. Department of Agriculture, Agricultural Stabilization and Conservation Service, Sugar Reports, No. 262, March 1974, p. 17.

2/ F. D. Gray, "Sweetener Consumption, Utilization, and Supply Patterns in the United States: Past Trends and Relationships, and Prospects for Target Years 1980 and 2000," (unpublished manuscript), p. 141.

Table IV-1
Leading Sugar Purchasing Industries, 1967.

SIC	Industry Description	Sugar Purchases (million $)	Sugar Purchases / Industry Sales
2087	Flavoring Extracts and syrups, n.e.c.	141.8	.12429
207	Confectionery and related products	194.3	.06815
2086	Bottled and Canned Soft Drinks	177.5	.05629
205	Bakery Products	234.0	.03305
2033	Canned Fruits and Vegetables	103.5	.02816
2024	Ice Cream and Frozen Desserts	36.8	.02759
2099	Food Preparations, n.e.c.	77.2	.02693
2035	Pickles, Sauces, and Salad Dressings	22.4	.02330
2041, 2043, 2045	Flour and Cereal Preparations	80.6	.02089
2023	Condensed and Evaporated Milk	31.1	.01863
2037	Frozen Fruits and Vegetables	32.8	.01469
	Total	1,132.0	

Source: U.S. Dept. of Commerce, Bureau of Economic Analysis, Input-Output Structure of the U.S. Economy: 1967, Vol. I, Transactions Data for Detailed Industries and Vol. II, Direct Requirements for Detailed Industries.

in the table accounted for about 94 percent of industrial sugar use and about 59 percent of total sugar use in 1967. The ratio of sugar purchases to total sales is known as the direct requirements coefficient (drc). This coefficient gives the needed purchases of sugar in order to increase sales by one dollar. For example, a drc of 0.1 for an industry means that, in order to increase industry sales by one dollar, additional sugar purchases equal to ten cents must be made.

Next, an estimate of industry sales was obtained for each of the ten leading firms in each of these sugar using industries. These estimates came from the EIS Datafile. There are a number of problems which keep the EIS estimates from being exactly correct. 1/ However, they can be used to obtain estimates of the market shares of the four or eight leading firms, since many of the deviations will tend to cancel out across firms.

The next step is to go from shares of output sold to shares of input purchased. In order to estimate purchases it is necessary to

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1/ The EIS Datafile is prepared by Economic Information Systems Incorporated, New York, N.Y. The technique employed required that the primary product of each plant be identified. Total shipments of the plant are then estimated by multiplying an estimate of total employment in the plant by the average productivity of labor for plants of that size in that industry. All of the output of the plant is considered to be of the single product. To get industry totals for the firm, the data for all plants belonging to the same firm and operating primarily in the same industry are summed.

Such estimates will deviate from actual sales where firms' actual labor productivity differs from the industry average. Such differences may result from variations in capital labor ratio or in technical efficiency across the firms in an industry. Other problems arise from errors in measurement by EIS, from failure to classify a plant into the proper industry, or from improper identification of plant ownership.

assume that purchases vary proportionately with sales of the output. 1/ In the case of an input such as sugar, this assumption is probably quite accurate. In most uses, sugar is probably what has been termed an ingredient input. As such, it probably satisfies the proportionality requirement even when noningredient inputs such as labor and capital do not. Under this assumption, the drc, which was seen to equal the ratio of total sugar purchased by the industry to total industry sales, will also be equal to the ratio of sugar purchased by each firm to the sales of that firm. 2/ Thus, by multiplying drc times firm sales in the

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1/ In general, purchases of an input will vary proportionately with output sales under the following assumptions:

1. All firms in the buying industry have the same production function--the technical relationship between inputs and outputs,

2. That production function is characterized by constant returns to scale; for example, a doubling in the rate of use of all inputs will result in a doubling in the rate of output; and

3. All firms in each industry face the same input price ratios.

In the case of an input such as sugar, strict adherence to these assumptions may not be necessary, since sugar is probably an ingredient input.

2/ In other words,

$$drc = \frac{\text{industry sugar purchases}}{\text{industry sales}} = \frac{\text{firm 1 sugar purchases}}{\text{firm 1 sales}}$$

$$= \frac{\text{firm 2 sugar purchases}}{\text{firm 2 sales}} = \ldots \text{ etc.}$$

industry, estimates of firm sugar purchases by industry can be obtained. 1/

A special adjustment to this procedure must be carried out in order to estimate the sugar purchases by firms in industries 2086, Bottled and Canned Soft Drinks, and 2087, Flavoring Extracts and Syrups, not elsewhere classified. Those syrups in 2087 that are not shipped to bottlers of soft drinks are generally shipped to the users (e.g., a distributor of syrups for fountain and ice cream use) in finished form. That is, the syrups contain sugar added by the maker. On the other hand, syrups shipped to soft drink bottlers are generally shipped in unfinished form. Sugar is later added by the bottling company. The one notable exception is Coca Cola syrup, which is shipped to the bottler in finished form by the syrup maker, The Coca Cola Company. 2/ In order to allow for these special circumstances, estimates of brand market shares and data on syrup shipments both to bottlers and to other users were obtained. Using this information, adjustments were made in the respective drc's of industries 2086 and 2087.

Once estimated sugar purchases were obtained for the ten leading firms in each leading sugar buying industry, total sugar purchases for each firm were calculated by summing the estimates over all industries in which that firm appeared. Using these firm totals, the share of the top four industrial sugar users (B4) was calculated to be 7.7 percent of industrial sugar use and 4.6 percent of total sugar use in 1967. The share of the top eight industrial buyers (B8) was calculated to be 11.5 percent of industrial purchases and 7.0 percent of total sugar purchases. By comparison with four firm (C4) and eight firm (C8) seller concentration, buyer concentration in the market for refined sugar is extremely low.

1/ I.e.,

firm 1 sugar purchases = (drc) x (firm 1 sales)
firm 2 sugar purchases = (drc) x (firm 2 sales)
.
.
.
etc.

2/ Also, approximately 60% of the syrup for its other flavors is shipped in finished form by The Coca Cola Company. (Telephone conversation with an official of The Coca Cola Company.)

Looking at nonindustrial users, it is possible to estimate the shares of retail sales for the four and eight leading grocery chains. These estimates are presented in Table IV-2. Assuming that these shares can be applied to purchases of sugar, the four and eight leading firms purchase 20 percent and 29 percent of sugar purchased by grocery stores, respectively. 1/ Based on these estimates, nonindustrial sugar buyer concentration appears to be somewhat higher than industrial sugar buyer concentration, but significantly less than seller concentration.

1/ Some sugar is purchased by brokers or wholesalers for resale to both industrial and nonindustrial (especially institutional) users. While the exact magnitude of such purchases is not known, it is believed to be small. Institutional use is less than one percent of total use. (See Sugar Reports, various issues.)

Table IV-2
Estimated 1973 Retail Market Shares of the Leading Grocery Chains.

Firm	Sales (Million $)	Market Share (%)
Safeway	6,774	6.88
A&P	6,748	6.86
Kroger	4,205	4.27
American	2,320	2.36
Lucky	2,290	2.33
Jewel	2,220	2.26
Winn-Dixie	2,110	2.14
Food Fair	2,092	2.13
Total Grocery Stores	98,392	100.00

1/ Sales figures are for company fiscal years containing the greatest number of months in calendar year 1973.

Sources: Moody's, Company Annual Reports, and U.S. Department of Commerce, Bureau of Economic Analysis, Survey of Current Business, December 1974.

V. The U.S. Sugar Program

Between 1934 and 1974, the Sugar Program constituted a comprehensive system of regulations covering the growing, importing, manufacturing, and marketing phases of the sugar industry. As succinctly described by Johnson, the Program's main features were:

"1. yearly establishment by the secretary of agriculture [sic] of total annual U.S. consumption requirements;

"2. allocation of total consumption requirements among domestic areas (cane and beet producing areas) and foreign countries;

"3. establishment of import quotas to control shipments by foreign countries of both raw and refined sugar to the United States;

"4. establishment of limits on direct-consumption sugar from Hawaii and Puerto Rico shipped to the continental United States;

"5. benefit payments made to domestic producers (including producers in Puerto Rico) for abiding by the terms of the Sugar Act;

"6. a tax of $0.50 per hundredweight of raw sugar on all sugar used in the United States;

"7. a tariff of $0.625 per hundredweight of [imported] raw sugar; and

"8. provisions for the 'fair division of the benefits' of the sugar program [among growers, processors, refiners, and labor]." 1/

Under the Sugar Act, 2/ the Secretary of Agriculture was required to annually determine the quantity of sugar needed for U.S. consumption "requirements" and to announce his determination for the coming year

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1/ D. Gale Johnson, The Sugar Program: Large Costs and Small Benefits, American Enterprise Institute for Public Policy Research, 1974, p. 10.

2/ For the last version of the Act, see, U.S. Department of Agriculture, Agricultural Stabilization and Conservation Service, Sugar Act of 1948 As Amended by . . . Public Law 138 - 92nd Congress, 1st Session, October 1971. Between 1960 and 1974, the Act was amended six times. The amendment of October 1971 will be discussed in the text. The other amendments are not relevant to our study.

between October and December. The amount of sugar consumers "require" (i.e., the amount they are willing to purchase) depended on the price of sugar, on real income, etc. The Act stated the price objective as follows:

> ". . . such determinations [of consumption requirements] shall be made so as to protect the welfare of consumers and of those engaged in the domestic sugar industry by providing such supply of sugar as will be consumed at prices which will equitably maintain and protect the welfare of the domestic sugar industry. . . ." 1/

However, there is an obvious conflict in that higher prices generally will increase the welfare of the sugar industry but may be "excessive" to consumers. The Act did provide some instructions on how this conflict should be resolved. The Secretary was instructed to "take into consideration the relationship between the price of raw sugar that he estimates would result from such determination and the parity index, as compared with the relationship between the average price of raw sugar during the three-year period 1957, 1958, and 1959, and the average of the parity indexes during such three years, with the view to attaining generally stable domestic sugar prices. . ." 2/ 3/

This provision provides an explicit price objective, although the Secretary is instructed merely to take the price objective "into consideration" as one among several objectives. The instruction that the the coming calendar year. Just how the Secretary is to estimate "requirements" is not clear, although the Act does provide some guidance.

1/ Sugar Act, Section 201. This section was amended in October 1971. The price objective as quoted was eliminated.

2/ Sugar Act, Section 201. The quoted material does not appear in the 1971 version of the Act.

3/ The parity index referred to is an index of all prices paid by farmers. It includes prices for all "family living items," livestock feed, motor vehicles, farm machinery, fertilizer, interest, taxes, and wage rates. The index is conceptually similar to a combination of the Consumer Price Index and the Wholesale Price Index specialized to the agricultural sector.

price objective should be pursued "with a view to attaining generally stable domestic sugar prices . . ." is puzzling. One would expect, and indeed this is exactly what happened, that when inflationary pressures developed in the economy, the explicit price objective set out in Section 201 would require the Secretary to take the necessary actions so that the domestic raw sugar price would rise by the same proportionate amount as the parity index. Under such circumstances, success in achieving the price objective implies failure in keeping sugar prices stable.

In spite of the potential conflict between different objectives, the fact is that the explicit price objective was closely adhered to throughout the decade of the sixties and the early years of the seventies. The price objective, perhaps because of its explicit operational nature, appears to be the key to understanding the active workings of U.S. sugar policy and, therefore, U.S. sugar production and prices.

The Mechanics of the U.S. Sugar Program "Price Objective"

It is important to know how the objective was calculated, what changes in the method of calculation were mandated by the October 1971 amendment to the Sugar Act, how the Secretary decided whether the price objective was being achieved, and what actions he could take if the objective was not being achieved. An example of the calculation for the month of January 1970 should make the procedure clear. The domestic price of raw sugar at New York City after the duty was paid averaged 6.21 cents per pound over the years 1957 through 1959. The "parity index" averaged 85.67 over the same period. 1/ By January 1970 the parity index had risen to 112, an increase of about 30.7 percent over the 1957-59 period. The price objective for January 1970 was 8.12 cents per pound. This is simply a 30.7 percent increase in the price of sugar relative to the base period; that is, 1.307 times 6.21.

The amendment of October 1971 changed the mechanics of calculating the price objective, and more significantly, virtually made its attainment the sole objective of the Act. The revised Section 201 instructed the Secretary to determine "the amount of sugar needed to meet the

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1/ The base period referred to is 1967; that is, in 1967 the index was 100.

requirements of consumers in the continental United States and to attain the price objective . . . ." But to choose a price is implicitly to choose a quantity. The two cannot be determined independently. In effect, the 1971 amendment established attainment of the price objective as the only responsibility of the Secretary of Agriculture under the Act. His instructions were made even more explicit in Section 202(g) of the revised Act:

> ". . . the determination of requirements of consumers shall be adjusted to the extent necessary to attain such price objective whenever the simple average of prices of raw sugar for seven consecutive market days is 4 per centum or more . . . above or below the average price objective so determined for the preceeding two calendar months . . . ."

Thus, the Sugar Act, as amended, required the Secretary to act whenever he was off target by more than 4 percent for 7 consecutive market days. Few economic targets can be hit with such precision but surprisingly, the "benchmark" price was usually kept within the narrowly specified bands even before the 1971 amendment.

The 1971 amendment also changed the method of calculating the price objective. The new base period price was taken to be the simple average of the monthly price objective calculated from September 1, 1970, to August 31, 1971. This average equals 8.55 cents per pound. Beginning in January 1972, the revised monthly price objective was calculated by multiplying this base figure by one plus the change since January 1972 in the simple average of the monthly parity index and the Wholesale Price Index (WPI) published by the Department of Labor. The average of these two indices for the base period was 115.4. By January 1972 the parity index had risen to 123 and WPI to 116.3. Their average was 119.6. This represented a 3.6 percent increase and so the January 1972 price objective was: 1.036 times 8.55 or 8.86 cents per pound. The introduction of the WPI appears to have had little effect on the level of the price objectives, because the WPI and the parity index were rising at about the same rate. Under the old method, the January 1972 price objective would have been 8.90 cents per pound instead of 8.86.

How Well Was the Price Objective Achieved?

To measure how well the price objective was achieved, it must be compared to a "benchmark" or reference price. Since at least June 1962, the Secretary of Agriculture had used the New York "spot price" for raw sugar after payment of the duty as the benchmark price. 1/ This is actually an estimated or nominal price rather than a market price. It is established daily by a committee of five members of the New York Coffee and Sugar Exchange. The "spot price" is used by the Exchange for settlements in the case of default or in taking delivery under future contracts. 2/ Although, strictly speaking, it is not a market price, the New York "spot price" seems to reflect other market prices very closely.

As Table V-1 shows clearly, the Secretary of Agriculture was remarkably successful in keeping sugar prices at or above the target, but he was not so successful in preventing sugar prices from rising substantially above the target level. Over the entire 15-year period, the annual average price was never more than 2.4 percent below the target. Between January 1972 and December 1974, the monthly spot price was no more than 6 percent below the target level. On the other hand, the annual average price was almost 24 percent above the target in 1963 and a whopping 138 percent in 1974. In November 1974, the monthly spot price was almost 4.5 times as high as the target price. Why this assymmetry? Chapter VI will discuss some possible explanations.

1/ See, U.S. Department of Agriculture, Agricultural Stabilization and Conservation Service, Sugar Reports, No. 121, June 1962, for the first published use of this benchmark price. Vernon Mund in Sugar Production and Marketing--With Special Reference to the Hawaiian Cane and Western Beet Industries, Economic Research Center, University of Hawaii, Honolulu, Hawaii, 1966, pp. 60-61, mentions that as of October 1961, the figures in Sugar Reports imply that the U.S.D.A. was using the New York wholesale price of refined sugar as a benchmark price. Table V-1 (based on unpublished tables obtained from U.S.D.A.) assumes that the raw "spot" price was the benchmark price in 1960 and 1961.

2/ Mund, pp. 13-14.

Table V-1
Determination of Price Objective for Raw Sugar as Specified in Sections 201 and 202 of the Sugar Act of 1948, as amended October 1971, 1960-1974

Month and Year	Parity Index (Prices by Farmers)	Wholesale Price Index	Average of Parity & Wholesale Price Index	Monthly Price Objective 1/	Most recent 2-month average of price objective 2/	Spot Price for raw sugar, duty paid at New York	Spot Price as percent of monthly price objective
1960	88	--	--	6.36	--	6.26	98.4
1961	88	--	--	6.40	--	6.30	98.4
1962	90	--	--	6.51	--	6.45	99.1
1963	91	--	--	6.61	--	8.18	123.8
1964	92	--	--	6.63	--	6.90	104.1
1965	94	--	--	6.80	--	6.75	99.3
1966	98	--	--	7.08	--	6.99	98.7
1967	100	--	--	7.25	--	7.28	100.4
1968	104	--	--	7.52	--	7.52	100.0
1969	109	--	--	7.91	--	7.75	98.0
1970	114	--	--	8.27	--	8.07	97.6
1971	120	--	--	8.69	--	8.52	98.0
1972							
Jan	123	116.3	119.6	8.86	8.82	9.10	102.7
Feb	124	117.3	120.6	8.94	8.90	9.02	100.9
Mar	124	117.4	120.7	8.94	8.94	9.16	102.5
Apr	125	117.5	121.2	8.98	8.96	8.89	99.0
May	125	118.2	121.6	9.01	9.00	8.76	97.2
June	126	118.8	122.4	9.07	9.04	8.77	96.7
July	127	119.7	123.4	9.14	9.10	9.17	100.3
Aug	127	119.9	123.4	9.14	9.14	9.33	102.1
Sept	128	120.2	124.1	9.19	9.16	9.39	102.2
Oct	129	120.0	124.5	9.22	9.20	9.32	101.1
Nov	130	120.7	125.4	9.29	9.26	9.03	97.2
Dec	131	122.9	127.0	9.41	9.35	9.19	97.7
1972 calendar year average	127	119.1	122.8	9.10	----	9.09	99.9
1973							
Jan	134	124.5	129.2	9.56	9.48	9.38	98.1
Feb	136	126.9	131.4	9.72	9.64	9.14	94.0
Mar	138	129.7	133.8	9.90	9.81	9.45	95.5

Table V-1 (continued)

Month and Year	Parity Index (Prices by Farmers)	Wholesale Price Index	Average of Parity & Wholesale Price Index	Monthly Price Objective 1/	Most recent 2-month average of price objective 2/	Spot Price for raw sugar, duty paid at New York	Spot Price as percent of monthly price objective
Apr	140	130.7	135.4	10.02	9.96	9.65	96.3
May	143	133.5	138.2	10.23	10.12	10.06	98.3
June	146	136.7	141.4	10.46	10.34	10.25	98.0
July	146	134.9	140.4	10.39	10.42	10.25	98.7
Aug	151	142.7	146.8	10.86	10.62	10.75	99.0
Sept	150	140.2	145.1	10.74	10.80	10.97	102.1
Oct	150	139.5	144.8	10.72	10.73	11.15	104.0
Nov	151	141.8	146.4	10.83	10.78	11.10	102.5
Dec	154	145.3	149.6	11.07	10.95	11.34	102.4
1973 calendar year average	145	135.5	140.2	10.38	-----	10.29	99.1
1974							
Jan	157	150.4	153.7	11.37	11.22	12.63	111.1
Feb	159	152.7	155.8	11.53	11.45	17.09	148.1
Mar	161	154.5	157.8	11.68	11.60	18.11	155.1
Apr	164	152.7	158.4	11.72	11.70	19.25	164.2
May	165	155.0	160.0	11.84	11.78	23.05	194.7
June	166	155.7	160.8	11.90	11.87	26.30	221.0
July	168	161.7	164.8	12.20	12.05	28.35	232.4
Aug	173	167.4	170.2	12.60	12.40	32.60	258.7
Sept	175	167.2	171.1	12.66	12.63	33.71	266.3
Oct	176	170.2	173.1	12.81	12.73	38.83	303.1
Nov	178	171.9	175.0	12.95	12.88	57.30	442.5
Dec	179	171.5	175.2	12.97	12.96	46.74	360.4
1974 calendar year average	168	160.9	164.5	12.19	-----	29.50	238.1

1/ Price objective specified in Sec. 201(b) of Sugar Act of 1948, as amended October 1971.

2/ Average of the price objective for the month shown and the month immediately preceding (i.e., the 2-month average for January 1974 included the price objective for December 1973 and January 1974), as specified in Sec. 202(g).

Source: United States Department of Agriculture, Agricultural Stabilization and Conservation Service, Sugar Reports, various issues; and tables supplied by U.S.D.A.

With the exception of the years 1963 and 1974, the monthly price objectives were achieved with remarkable consistency. Thus, except for periods of sharply increasing world sugar prices, total quota determinations appear to have been made with an eye toward achieving a well-defined price objective.

Quota Allocations

The main tool available to the Secretary for "fine tuning" the price of raw sugar was the determination of total sugar requirements; that is, the total quota to be allocated. Quotas were allocated to domestic cane and beet producers and to over 30 foreign countries. Basic quotas were established in the legislation for domestic producers, the Philippines, and Ireland. Proportionate shares of remaining needs were specified for the remaining countries. The Act gave the President of the United States the power to bar imports from a country if he found it to be in the national interest and forbade the importation of sugar from Cuba until such time as diplomatic relations with that country were re-established. The Secretary of Agriculture was given the power to replace any sugar lost through such import bans by allocating "temporary" quotas. The Secretary was also permitted to allocate any projected deficit of one or more producing groups among other producers subject to certain regulations concerning the share going to each. 1/

As can be seen from Table V-2, the quotas have generally been filled, even in those few years when world sugar prices were above U.S. prices. 2/ The only exception was in 1974, when the final foreign quota was only 85 percent filled. Foreign behavior in 1974 will be discussed in the next chapter.

1/ Sugar Act, Section 202.

2/ Contractual commitments may account for foreigners' actions in those few years.

Table V-2
Final Allocated Quotas and Quota Charges
in the Continental United States

Year	Area	Final Allocated Quotas (short tons, raw value)	Total Charges (short tons, raw value)	Total Charges / Final Allocated Quotas %
1961	Total Domestic	5,351,500	5,432,073	101.5
	Total Foreign	4,468,500 a/	4,300,188	96.2
	Grand Total	9,820,000 a/	9,732,261	99.1
1962	Total Domestic	5,276,000	5,201,496	98.5
	Total Foreign	4,710,364 b/	4,595,725	97.5
	Grand Total	9,986,364 b/	9,797,221	98.1
1963	Total Domestic	5,663,463	5,959,778	105.2
	Total Foreign	4,706,135 c/	4,555,215	96.7
	Grand Total	10,369,598 c/	10,514,993	101.4
1964	Total Domestic	5,650,832	5,522,669	97.7
	Total Foreign	3,639,293 d/	3,586,538	98.5
	Grand Total	9,290,125 d/	9,109,207	98.0
1965	Total Domestic	6,081,985	6,094,746	100.2
	Total Foreign	3,829,798	3,825,366	99.8
	Grand Total	9,911,783	9,920,112	100.0
1966	Total Domestic	6,041,632	6,041,028	99.9
	Total Foreign	4,333,368	4,314,216	99.5
	Grand Total	10,375,000	10,355,244	99.8
1967	Total Domestic	6,362,543	5,950,637	93.5
	Total Foreign	4,437,457	4,432,893	99.8
	Grand Total	10,800,000	10,383,530	96.1
1968	Total Domestic	6,026,371	5,984,948	99.3
	Total Foreign	4,973,629	4,965,662	99.8
	Grand Total	11,000,000	10,950,610	99.5

Table V-2 (continued)

Year	Area	Final Allocated Quotas (short tons, raw value)	Total Charges (short tons, raw value)	Total Charges / Final Allocated Quotas %
1969	Total Domestic	5,946,570	5,885,931	98.9
	Total Foreign	4,853,430	4,849,039	99.9
	Grand Total	10,800,000	10,734,970	99.3
1970	Total Domestic	6,410,486	6,374,929	99.4
	Total Foreign	5,189,514	5,177,020	99.7
	Grand Total	11,600,000	11,551,949	99.5
1971	Total Domestic	5,922,333	5,923,414	100.0
	Total Foreign	5,377,667	5,370,178	99.8
	Grand Total	11,300,000	11,293,592	99.9
1972	Total Domestic	6,358,638	6,402,421	100.6
	Total Foreign	5,441,362	5,437,224	99.9
	Grand Total	11,800,000	11,839,645	100.3
1973	Total Domestic	6,381,000	6,343,045	99.4
	Total Foreign	5,364,544 e/	5,333,256	99.4
	Grand Total	11,745,544 e/	11,676,301	99.4
1974	Total Domestic	5,734,333	5,446,274	95.0
	Total Foreign	6,765,667	5,774,310	85.3
	Grand Total	12,500,000	11,220,584	89.8

a/ 180,000 short tons of final adjusted quota not allocated by U.S. Dept. of Agriculture.

b/ 13,636 short tons of final adjusted quota not allocated by U.S. Dept. of Agriculture.

c/ 30,402 short tons of final adjusted quota not allocated by U.S. Dept. of Agriculture.

d/ 509,875 short tons of final adjusted quota not allocated by U.S. Dept. of Agriculture.

e/ 54,456 short tons of final adjusted quota not allocated by U.S. Dept. of Agriculture.

Source: U.S. Dept. of Agriculture, Agricultural Stabilization and Conservation Service, Sugar Statistics, and Sugar Reports, No. 277, June 1975, p. 14.

The Current State of Regulation

At the end of 1974, many of the features of the Sugar Program were allowed to expire. A vestigial program including benefit payments to domestic producers and the setting of fair wages in the sugar industry remained until the end of June, 1975. These features have now expired as well. While individual country and domestic area quotas no longer exist, an overall limit to imports of 7 million tons has been set by the President. This overall quota was deliberately set at a nonrestrictive level in order to prevent a tariff of $1.875 per hundredweight from replacing the existing tariff of $0.625 per hundredweight. 1/

1/ In the absence of a quota, such an increase is required by law. (Telephone interview with E. H. Boyles, Sugar Division, U.S. Department of Agriculture.)

VI. The Behavior of Sugar Prices

The previous chapter discussed the regulatory framework within which the workings of the demand for and the supply of sugar in the United States must be evaluated. These regulations required the Secretary of Agriculture to maintain the price of raw sugar at a price objective determined by the level of the farmers' parity index and the wholesale price index. The main tool for controlling the actual price was the Sugar Act quota system, which allowed the Secretary to limit the amount of sugar that could be marketed in the United States. An attempt to explain the prices observed under this system of regulation will be the focus of this chapter. In the process, an attempt to explain the high price of sugar in 1974 will be made.

As noted in Chapter V, remarkable success was attained by the Secretary of Agriculture in keeping the price of sugar in the U.S. from falling below the price objective. As Table V-1 shows, the annual average spot price for raw sugar in New York, after payment of duty, was never more than 2.4 percent below the price objective. However, the Secretary was not so successful in keeping actual prices from rising above the price objective. In 1963 the average spot price was 123.8 percent of the price objective. In November 1974 the actual price was 442.5 percent of the price objective. For the year 1974, the actual price was more than double the price objective.

Table VI-1 shows the relationship between the price of raw sugar at New York, after payment of duties, and the price on the world market. The quota premium shown in the table is the difference between the U.S. price and the world price after adjustment for duty and transportation costs to New York. It will be noted that the quota premium is positive-that is, a supplier makes more money on the average by selling in the U.S. market than selling in the world market--in every year except in 1963, 1973, and 1974.

Together, Tables V-1 and VI-1 suggest a pattern. When the world price of raw sugar is below the price objective, the price in the United States is equal to the price objective. When the world price exceeds the price objective, the actual price in the U.S. exceeds the price objective. The domestic price does not, however, increase to the level of the world price. The quota premium becomes negative.

Table VI-1
U.S. and World Raw Sugar Prices
and Quota Premium, 1961-74
(cents per pound)

Year	U.S. Price a/	Duty, Insurance, Freight, Unloading Charges	World Price b/	Quota Premium
1961	6.30	0.94	2.91	2.45
1962	6.45	0.89	2.98	2.58
1963	8.18	0.91	8.50	-1.23
1964	6.90	0.92	5.87	0.11
1965	6.75	0.95	2.12	3.68
1966	6.99	0.96	1.86	4.17
1967	7.28	0.96	1.99	4.33
1968	7.52	0.98	1.98	4.56
1969	7.75	1.00	3.37	3.38
1970	8.07	1.13	3.75	3.19
1971	8.52	1.12	4.53	2.87
1972	9.09	1.10	7.43	0.56
1973	10.29	1.38	9.61	-0.70
1974	29.50	1.63	29.99	-2.12

a/ New York spot price for bulk sugar under contract No. 10, duty paid or duty free.

b/ Spot price for bulk sugar under contract No. 11, which, beginning January 1971, replaced Contract No. 8. The terms of these contracts are f.o.b. and stowed at Greater Caribbean ports including Brazil.

Source: U.S. Department of Agriculture, Agricultural Stabilization and Conservation Service, Sugar Statistics, Vol. I, Revised December 1969, and Sugar Reports, various issues.

Why was the Secretary of Agriculture so much more successful in keeping the U.S. price equal to the price objective when the price objective was above the world price than he was when the price objective was below the world price? When the price objective exceeded the world price, the Secretary's task was quite simple. He had the power under the Sugar Act to limit sales in the United States. With the U.S. price being higher than the world price plus freight and duties, producers would be anxious to sell their raw sugar in the U.S. market. By selling in this country their profits would be increased. All the Secretary had to do was to determine how much sugar each producing country would be permitted to market. Provided the Secretary correctly selected the total amount of sugar to be imported, the cane sugar refineries would keep the price up to the price objective by bidding against one another for the available supply of raw sugar.

What are the conditions which bring about world and U.S. prices in excess of the price objective? The years 1963 and 1973-74 are the only periods since 1960 when these conditions have occurred; therefore, these two periods must be analyzed. One characteristic of both periods was the declaration of substantial deficits in domestic sugar production. In the year prior to each period, deficits had also been declared. The Sugar Act required the Department of Agriculture to declare a deficit any time the best available information indicated that a domestic or foreign producing area would not be able to fill its quota. When a deficit was declared, the amount of the deficit was reallocated to other producing areas.

During 1962, deficits totaling 729,000 short tons were declared for domestic producing areas. This contrasted with the previous year when the domestic producing areas had been able to satisfy the total domestic quota. 1/ On May 6, 1963, a deficit of 291,000 tons was declared for the domestic beet area. A deficit of 40,000 tons for Hawaii was declared on October 22, 1963. Puerto Rico also had deficits totaling 250,000 tons during 1963. The 1962 domestic deficits amounted to 7.7 percent of originally announced total U.S. sugar requirements for the year. In 1963 domestic deficits amounted to 6.1 percent of requirements originally announced.

1/ Deficits had been declared in Pureto Rico and Hawaii in 1961. However, these had been reallocated to the domestic beet and domestic cane areas.

The 1973-74 period was also characterized by substantial deficits in domestic producing areas. In the preceding year--1972--there were total domestic deficits of 1,049,600 tons. Of this amount 704,000 tons was a deficit assigned to Puerto Rico. Because Puerto Rico had been running large deficits since the early 1960's, a continuing deficit should have been foreseen by everyone involved in sugar growing and production. The remaining 345,600 tons were for the domestic beet and Hawaiian cane areas. Except for a shortage in domestic beets in 1968, these areas had not run deficits since 1963.

Domestic deficits for areas other than Puerto Rico totaled 249,000 tons in 1973. From the beginning, deficits for domestic producing areas other than Puerto Rico were a major factor in 1974. On November 2, 1973, when requirements for the year were announced, a deficit of 392,000 tons for the domestic beet area was also announced. Additional deficits for domestic beets were announced on December 11, 1973; January 11, 1974; and September 25, 1974. The total 1974 deficit for this one source of sugar was 650,334 tons. Sugar cane production also suffered in 1974. In March a deficit of 40,000 tons of cane was declared for the Texas growing region. In addition to increasing the beet deficit, the September 25th announcement also declared deficits of 350,000 tons for the mainland cane area and 100,000 tons for the Hawaiian cane area. 1/ Total domestic deficits for 1974, excluding Puerto Rico, amounted to 1,140,334 tons. In addition, Puerto Rico ran its now normal deficit of 700,000 tons.

In percentage terms, domestic deficits in 1974, excluding Puerto Rico, amounted to 9.7 percent of originally announced U.S. requirements for the year. The original quotas for 1974 had called for 5.5 million

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1/ The shortage of cane grown on the mainland appears mainly to be a shortage of cane grown in Florida. Actual quota charges of Florida sugar cane processors in 1974 were down 313,500 tons from 1973 levels. (U.S. Department of Agriculture, Agricultural Stabilization and Conservation Service, Sugar Reports, No. 273, February 1975.)

tons of sugar to be furnished by foreign countries. During the year, total requirements were increased by 700,000 tons. This, together with the allocation of the domestic deficits to foreign countries, resulted in a final foreign quota of 6.8 million tons--a 23.6 percent increase during the year. 1/

Do these domestic shortages hold the key to the high U.S. prices in the 1963 and 1973-74 periods? In order to answer this question, it is necessary to consider how foreign producers meet the increases in U.S. demand for their output which result from such deficits. It is not possible to increase the supply of raw sugar in the short run. Sugar cane is a perennial requiring 15 to 24 months between the time it is planted and the time it yields its first crop. 2/ Thus, it is technologically impossible to respond to changed conditions of demand in less than 18 months to two years. 3/

Since the supply of raw sugar is fixed in the short run, the only way increased U.S. demand for foreign sugar can be satisfied is for foreign sellers to reduce the amount of sugar going to other users. Such sugar as is diverted is apt to come from amounts that would have been traded on the world market. Such diversion will occur only if U.S. buyers are willing to meet the price foreign sellers could have obtained in the world market. That is, U.S. buyers are not protected from the world price if the world price exceeds the price objective of the Secretary of Agriculture and if purchases in the world market are necessary to satisfy U.S. demand. This is the major reason actual prices cannot be kept from going above the price objective.

1/ All figures on deficits and allocations in this discussion are drawn from U.S. Department of Agriculture, Agricultural Conservation and Stabilization Service, Sugar Statistics, Vol. I, Revised December 1969, and Sugar Reports, various issues. Some of the data also came from tables prepared for Sugar Statistics, Vol. I, Revised December 1974, which were furnished by the Department of Agriculture.

2/ This is based on the growing time for domestically grown sugar cane. It is assumed that cane grown in foreign countries would require about the same growing season. See, Sugar Statistics, Vol. I, Revised December 1969, p. 171.

3/ Of course weather conditions can affect the amount of sugar harvested. Weather is ignored here, as it is beyond human control.

It is not surprising that a substantial increase in demand by the U.S. should result in a large price increase on the world market. Prior to 1975 the amount of sugar traded on the world market was only a small percentage of total world production. Most large consuming nations bought their sugar under protective agreements like the U.S. Sugar Act rather than on the open market. Somewhere between 10 and 15 percent of the world's sugar production was traded on the world market. 1/ The annual total amount of sugar traded on the world market was equivalent to about 70 to 80 percent of total annual U.S. consumption requirements. Thus, the world market was indeed quite thin.

It was noted before that domestic deficits in 1963 amounted to 6.1 percent of original U.S. requirements and that, during 1974, increases in U.S. demand for foreign sugar amounted to 1.3 million tons. This is 11 percent of originally announced U.S. requirements. Given the size of the world market, these increases would have caused world market demand to expand by 7.5 to 8.5 percent in 1963 and 13.5 to 16 percent in 1974. These large increases in demand pressing on a fixed supply are a sufficient explanation of large U.S. and world sugar price increases in 1963 and in 1973-74.

The 1.3 million ton increase in U.S. demand for foreign sugar during 1974 may also explain why foreigners filled only 85 percent of their 1974 final quota. In order to supply the additional sugar demanded, foreigners would have had to increase shipments to the U.S.

1/ World market sales were 8.6 million short tons in calendar year 1971 and 9.6 million tons in 1972. World production figures are reported on a crop year rather than calendar year basis. For the 1970-71 crop year, world production was 77.7 million short tons; for 1971-72, production was 77.8 million tons. (World market sales data are from Internation Sugar Organization, Annual Report for the Year 1972. World production figures are from U.S. Department of Agriculture, Foreign Agriculture Service, Foreign Agriculture Circular: Sugar, December 1974.)

With the termination of most of the Sugar Program at the end of 1974, the world market was expanded by the amount of U.S. sugar use.

by about 27 percent over the 1973 level. As indicated in Table VI-2, foreign shipments charged against the U.S. quota grew by an average of three percent per year during the period 1962-74. The largest increase was 13 percent from 1965 to 1966. Thus, to supply the 1974 increase in demand would have required an increase more than double the largest one achieved in recent years. It is reasonable to infer that such an expansion was beyond the capability of foreign suppliers.

An alternative explanation of foreigners' nonfulfillment of the U.S. quota in 1974 is in terms of an "announcement effect." 1/ Foreig suppliers knew over a year in advance that the Sugar Program might end after 1974. 2/ With the possibility that there would be no 1975 quotas to lose, those suppliers may have diverted sugar from the relatively low priced U.S. market to the higher priced world market in 1974 However, the relatively large--eight percent--increase in foreign charg from 1973 to 1974 is hardly consistent with such diversion. The 1973-7 increase is more than double the average change for all years 1962-74 and is also greater than the average change for those years in which both foreign quotas and charges were expanded over the previous year.

Having seen that the situation in 1973-74 was similar to that in 1963, it is of interest to ask what insights market behavior in 1964-65 offer for 1975 and beyond. In 1963 the deficits declared for the domestic beet producing areas were not realized. Sugar beet production was higher than expected and the original beet sugar quota was met. In addition, the mainland cane area produced a surplus of 60,000 tons. 3/ As a result, sugar was in plentiful supply at the beginning of 1964 and prices fell rapidly. Total U.S. requirements for 1964 were set at 9.8 million tons--the same level as the originally announced requirements for 1963. However, statistics on the 1964 foreign quotas show that

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1/ This argument is presented in David Carter, Vice President and President-elect of United States Beet Sugar Association, "Statement Before the Council on Wage and Price Stability," November 25, 1974.

2/ The Department of Agriculture announced in November 1973 that it was proposing elimination of import quotas and production restriction (See Wall Street Journal, November 5, 1973.)

3/ Sugar Statistics, Vol. I, p. 124.

Table VI-2
Annual Rates of Change of Foreign Charges against U.S. Quota, 1962-74.

Year	Rate of Change over previous year (percent)
1962	7
1963	-1
1964	-21
1965	7
1966	13
1967	3
1968	12
1969	-2
1970	7
1971	4
1972	1
1973	-2
1974	8
Average for all years	3
Average for years of increase	7

Source: See Table V-2.

509,875 tons of these quotas were never made available for allocation. 1/ This suggests that the extra imported sugar was not needed to satisfy U.S. needs. The reduced U.S. demand for foreign sugar was an additional factor tending to depress world sugar prices in 1964. The success of domestic crops, with the exception of Puerto Rico, also tended to keep prices down.

The situation in 1974 was somewhat different. First of all, the declared deficits in 1974 as a fraction of total needs were almost twice as large as the shortages expected in 1963. Secondly, the 1974 deficits were realized. Domestic beet production amounted to only 3,027,000 tons, 600,000 tons below the basic quota for domestically produced sugar beets. Mainland cane production was 400,000 tons short of its original quota level; and Hawaiian cane production was 100,000 tons short of its original quota. 2/ These factors suggest that prices will not fall as rapidly in 1975 as they did in 1964.

Domestic production of sugar is expected to be greater in 1975 than it was in 1974. This should help reduce sugar prices. Table VI-3 gives acreage planted in sugar beets for the years 1965-74. From the Table it can be seen that 1974 plantings were only 1,254,100 acres. This is the smallest acreage planted in sugar beets since 1967. Expected 1975 plantings, as of March 26, were 1,546,900 acres. 3/ This represents a 23 percent increase in acres planted and should bring about a similar increase in acres harvested. If the yield per acre returns to the levels of 1971-73, production of sugar beets should be increased by about 35 percent. This increase should be another force tending to decrease the price of sugar in 1975.

1/ Sugar Statistics, Vol. I, p. 125.
2/ Sugar Reports, No. 258, November 1973, and No. 272, January 1975.
3/ Sugar Reports, No. 274, March 1975.

Table VI-3
Sugar Beets: Acreage Planted and Harvested,
Yields and Prices Received by Farmers, 1965-1974

Year	Acreage Planted (1,000 Acres)	Acreage Harvested (1,000 Acres)	Yield Per Harvested Acre (Short - Tons)	Production (1,000 Short-Tons)	Price Per Ton
1965	1,314	1,248	16.8	20,915	11.90
1966	1,240	1,161	17.5	20,342	12.80
1967	1,197	1,122	17.1	19,197	13.50
1968	1,476	1,410	18.0	25,363	13.80
1969	1,647	1,541	18.0	27,736	12.70
1970	1,478	1,413	18.7	26,378	14.82
1971	1,404	1,340	20.2	27,068	15.40
1972	1,420	1,329	21.4	28,410	16.00
1973	1,280	1,278	20.1	24,499	29.70
1974	1,254	1,217	18.3	22,268	58.70

Sources: U.S. Department of Agriculture, Agricultural Reporting Service, Agricultural Statistics, 1972, and telephone conversation with Agricultural Reporting Service official.

The Cause of the 1974 Deficit in Domestic Sugar Beet Production

According to the previous discussion, a very large deficit in the domestic production of sugar beets was an important factor in the increases in sugar prices during 1974. Table VI-3 shows that total acreage planted in sugar beets was 10 percent below previous levels in both 1973 and 1974. 1/ Why did farmers reduce their plantings of sugar beets in these two years?

The president of the United States Beet Sugar Association has suggested that plantings were reduced because farmers could make a better profit by planting other crops. 2/ Comparing the prices received by farmers for sugar beets with prices received for other crops should permit a test of this claim. Table VI-4 compares prices received for sugar beets with prices received for all crops. Both sets of figures are expressed as index numbers, with 1970 prices received set equal to 100. The table shows that prices received for other crops were increasing faster than the prices received for beets between 1970 and 1972. Farmers cannot make immediate output adjustments in response to changes in relative prices; rather they must wait until a new crop can be planted. Thus, the relative decline in prices for sugar beets in the 1970-72 period might explain the decreased acreages in sugar beets in 1973 and 1974. 3/ However, it is not possible to tell whether the absolute levels of prices received for sugar beets were higher or lower than those for other crops, since both series of data are index numbers. 4/ Table VI-4 does show that prices received for sugar beets had increased much more rapidly in the late 1960's than had those for other crops.

1/ In addition, the quantity of beets harvested per acre was down substantially in 1974.

2/ Carter, "Statement Before the Council on Wage and Price Stability."

3/ Sugar beets are an annual. Given the institutional arrangements determining returns to growers and the time required to grow mature beets, the lag of supply response to a change in relative prices could be from one to two years.

4/ Another factor ignored here is yields per acre of different crops. Relative changes in yields per acre or overall productivity would influence farmers' decisions as to what crops to plant.

Table VI-4
Indexes of Prices Received by Farmers:
Sugar Beets vs. All Crops
(1970 = 100)

Year	Sugar Beets	All Crops
1965	80	103
1966	86	104
1967	91	100
1968	93	101
1969	86	97
1970	100	100
1971	104	107
1972	108	115
1973	200	164

Sources: Column 1: Price per ton of sugar beets data from Table VI-3 indexed to 1970 = 100; Column 2: U.S. Department of Commerce, Office of Business Economics, Business Statistics, 1971, and Survey of Current Business, various issues.

The data in Table VI-3 on acres of sugar beets planted show that plantings were fairly stable between 1968 and 1972. This suggests that the returns from growing sugar beets were high enough relative to the returns from growing other crops in the 1966-70 period to make sugar beets a profitable crop. The differences between the prices received for sugar beets and for other crops were certainly not smaller in the late 1960's than they were in the early 1970's. Thus, the evidence appears to be mixed, and it is not possible to accept or reject conclusively this explanation for reduced sugar beet production.

If the actual relative price for sugar beets did not fall sufficiently to explain the decline in plantings, another explanation is needed. Such an explanation may possibly be found in the attempts of the U.S. Beet Sugar Association to get all price controls removed from their industry. According to the association, the price controls were reducing the relative price of sugar beets and were, therefore, making sugar beet production less profitable than other crops. 1/ As part of their effort to get the price controls lifted, U.S. Beet Sugar encouraged their members to write to the Cost of Living Council claiming that sugar beet production was being made unprofitable because of the regulations. This letter writing campaign was being carried out during the winters of 1972-73 and 1973-74, when farmers were deciding what crops to plant for the next year. While this lobbying effort did not succeed in getting the price controls lifted, it may have made the farmers believe that sugar beets were becoming an unprofitable crop. 2/

Farmers decide what to plant on the basis of the expected profitability of growing various crops. One factor which is apt to influence this expectation is the actual returns in the previous year or two. However, information from the trade association suggesting the declining profitability of a crop will also affect farmers' expectations. The

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1/ The mechanism by which this assymetric effect of the price controls was alleged to have occurred will be discussed in the next section which will also attempt to evaluate the claim that the price controls were responsible for any decline in relative prices.

2/ Telephone conversation with Mr. David Carter, President of United States Beet Sugar Association.

lower expected returns may then cause farmers not to plant that crop. Thus, the psychological impact the lobbying effort had on the sugar beet farmers may also have been a significant factor in the acreage reductions.

The Impact of Cost of Living Council Regulations on Sugar Beet Profitability

As noted above, the United States Beet Sugar Association believed the major cause of the reduced profitability of growing sugar beets was the regulation of prices by the Cost of Living Council. There were price controls of one type or another in this country from August 15, 1971 to April 30, 1974. For a 90-day period beginning August 15, 1971, all prices were frozen. Another price freeze was imposed from June 13 to August 11, 1973. Between November 15, 1971, and June 12, 1973, and again from August 12, 1973 to April 30, 1974, price increases were permitted if they could be justified by increases in costs. During these latter periods, prices of raw agricultural products were not regulated. They were free to find their own competitive levels. Processors of such commodities were allowed to increase their prices to cover any increases in commodity costs.

It is during the periods when prices of raw agricultural products were supposed to have been free of controls that the Cost of Living Council (CLC) regulations are alleged to have held down the returns from growing sugar beets. This came about as a result of the institutional arrangements under which sugar beets are processed and the resulting sugar is marketed. Growers and processors of sugar beets enter into participatory or risk-sharing agreements. The contracts specify that the grower will receive a certain fraction of the revenue realized from the sale of the refined sugar obtained from his beets. The normal split is about two-thirds for the grower and one-third for the processor. This is the price the grower receives for his crop. It clearly differs from the normal notion of a price, since it can only be determined after the crop has been processed and the beet sugar sold. 1/

1/ Carter, "Statement Before the Council on Wage and Price Stability."

This arrangement posed a problem under the CLC regulations because there was no sugar beet price which could be decontrolled. The price paid to the grower depended on the price of refined beet sugar, which is a manufactured product. As such, the price of refined beet sugar could only be increased if justified by increased costs. Since there was no independent price for sugar beets, there were no increases in costs. 1/ As a result, beet sugar prices could not be increased. However, increases in beet sugar prices are necessary if the prices paid to the farmers are to increase. Thus, returns to the farmers remained fixed or fell.

Can the CLC regulations in fact be held responsible for the reduced profitability of growing sugar beets, or would these conditions have arisen even in the absence of price controls? Before investigating this question, attention should be given to the CLC's response to this problem. On August 30, 1972, nine months after agricultural prices were supposed to be decontrolled, CLC enacted a regulation designed to deal with the problem of participatory or risk-sharing marketing arrangements. This regulation provided methods by which cost increases could be imputed when the existence of a participatory or risk-sharing arrangement meant that no commodity price could be observed. One of the ways price increases could be justified under this regulation was:

> "(4) The published price or average documented price paid by competitors for a related product or service that has a similar price pattern in the same marketing areas or in the closest substantially similar marketing area [could be used to impute cost increases]." 2/

With the enactment of the August 1972 regulation, increases in the price of beet sugar could be justified by increases in the price of raw cane sugar.

1/ The prices received by farmers for sugar beets under the participatory arrangements obviously could not serve as the basis for increased costs since those received prices were a function of beet sugar prices.

2/ 6 C.F. R. 300.22 (1973).

The question of CLC's impact on the sugar situation can now be restated. Was the price of beet sugar artifically restricted in the period from November 1971 through August 1972? After August 1972, did the new regulation adequately correct any problem that had existed? Two series of data are relevant in attempting to answer these questions.

First, it is useful to compare the price of beet sugar with the price of refined cane sugar for the early 1970's. The raw agricultural product used in producing refined cane sugar is raw sugar, which is obtained for a fixed price rather than under a participatory contract. Thus, if the problem of the participatory contract did restrict the price of beet sugar, it is possible that the price of beet sugar was less than that of cane sugar during this period.

Table VI-5 shows quoted wholesale prices for refined cane and refined beet sugar in the Chicago-West region. This region was selected because large quantities of both cane and beet sugar are traded in this market. 1/ Cane sugar sold at a higher quoted price than did beet sugar during the period 1965-67. The two kinds of sugar then sold for the same quoted price until August 1973, when cane sugar again began to be quoted at a premium. This premium remained through the end of 1974.

The pattern of premiums on the price of cane sugar does not seem to conform with the pattern one would expect if CLC regulations were responsible for the price differences. There are no premiums in 1971 or 1972, when the problem was the greatest. The premiums first appear in August 1973--a full year after CLC had enacted provisions allowing beet processors to impute cost increases. Further, the price premiums do not disappear in May of 1974, despite the fact that CLC regulations expired on April 30, 1974.

Another explanation of the relatively higher prices of cane sugar seems to be needed. One possibility is to be found in the rapidly rising prices of late 1973 and most of 1974. During this period, wholesale price increases were being announced almost weekly. Companies did not always make their price increases effective on the same date. Thus,

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1/ Cane sugar also competes with beet sugar on the West Coast. However, the major producer of cane sugar in that area is California and Hawaiian Sugar, which is a cooperative. As such, it would have faced the same problems as beet processors in justifying price increases.

Table VI-5
Quoted Wholesale Prices for Refined Cane Sugar and Refined Beet Sugar in Chicago-West Region, 1965-1974
(cents per pound)

	Chicago-West Region	
	Cane Sugar	Beet Sugar
1965	9.35	9.15
1966	9.64	9.44
1967	9.82	9.70
1968	9.94	9.94
1969	10.23	10.23
1970	11.08	11.08
1971	11.59	11.59
1972	11.82	11.82
1973		
Jan	11.65	11.65
Feb	11.65	11.65
March	11.55	11.55
April	11.75	11.75
May	11.87	11.87
June	11.95	11.95
July	11.95	11.95
Aug	12.36	11.95
Sept	13.48	12.99
Oct	13.95	13.95
Nov	13.84	13.69
Dec	13.80	13.64
1974		
Jan	14.87	14.64
Feb	18.09	17.80
March	22.12	20.18
April	23.73	21.99
May	27.07	26.65
June	31.16	30.40

Table VI-5 (continued)

	Chicago-West Region	
	Cane Sugar	Beet Sugar
July	32.25	32.15
Aug	36.30	33.93
Sept	40.74	36.19
Oct	43.59	40.17
Nov	60.90	54.68
Dec	60.41	56.02

Sources: U.S. Department of Agriculture, Agricultural Stabilization and Conservation Service, Sugar Statistics, Vol. I, Revised December 1969, and Sugar Reports, various issues.

one company's sugar might sell at a higher list price than did another company's for a few days. Whether it did in fact sell at a higher price is impossible to determine. Discounting from quoted prices is a common event in the sugar industry; and in at least one case, a company announcing a price increase noted that while their new list price exceeded that of some other firms, they would discount to meet competitive conditions.

The fact that price increases in cane sugar led those in beet sugar can be explained by the organization of the two processes. Since cane refiners use raw sugar which is traded for a fixed price and buy raw sugar continuously, they soon feel the pressure of rising sugar prices. 1/ Accordingly, they must raise their prices in order to avoid losing money. Since beet processors do not buy raw sugar, they do not feel the same pressures. Processors' payments to growers are a function of the price of beet sugar, and any increases in that price are reflected in increased profits for both growers and processors. The only pressure on the price of beet sugar is the increased demand which would result if beet sugar prices were to remain below cane sugar prices.

Even though the price data do not appear to support the allegation that CLC regulations were responsible for reduced profitability in growing sugar beets, the claim may still be true. It is possible that cane refiners did not increase their prices even though they had cost

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1/ The pressure of high raw sugar prices seems to be behind SuCrest's decision announced on March 20, 1975, no longer to compete with beet processors in the Chicago-West region. (Wall Street Journal March 21, 1975, p. 22.)

increases that would have justified such price increases. The cane refiners may have felt that they would lose too many sales if they charged a price above the beet sugar price. 1/ 2/

Evidence relating to this possibility is presented in Table VI-6, which shows refiners' margins in the Chicago-West region. The margins were computed by taking the difference between the quoted wholesale price of 100 pounds of refined sugar in the Chicago-West region and the price of 107 pounds of raw sugar needed to produce the 100 pounds of refined sugar. 3/ The price of raw sugar used was the price after payment of duties. Thus, the cost of transporting the raw sugar from New York to the refinery as well as the costs of refinery operations must be covered by the margin. Annual average margins are given for the period 1965 to 1971. For 1972 through 1974, monthly margins are presented on both a concurrent basis and on a one month lagged basis--that is, the difference between the price for which 100 pounds of refined sugar could be sold this month and the price which would have been paid for 107 pounds of raw sugar purchased last month. It is not clear which of these figures more accurately represents the profitability of sugar refining, since sugar refiners do normally hold inventories of raw sugar. Such inventories normally amount to less than one month's usage.

1/ One problem with this explanation is that the loss of sales should not have occurred if the market clearing price was above the restricted beet sugar price. However, the important consideration here is what sellers believed would happen, not what actually would have occurred. A second possibility is that the cane refiners feared that a temporary premium on the price of cane sugar would cause them to lose the goodwill of their customers. This could have had long-run implications.

2/ Another possibility is that Cost of Living Council regulations did not permit cane sugar prices to increase adequately. However, this does not seem to be the case, as margins in the Northeast region, where cane refiners do not face heavy competition from beet sugar, did not fall as substantially as those in Chicago-West. (See Bruce Walter, "1974 Sugar Price Increase," Staff Report to the Council on Wage and Price Stability, November 25, 1974.)

3/ The figures in Table VI-6 should be used with caution. The refined sugar price used in these calculations is just the area price for the Chicago-West region. To the extent that freight prepays differ from actual freight charges, the margins shown in the table will differ from the actual margins. However, comparisons over short periods of time should pose few problems, as neither freight prepays nor actual transport charges change drastically over a period of a few years. It should also be noted that the behavior of refiner margins in the Chicago-West region is not necessarily representative of their behavior in other regions. (For a complete discussion of the wholesale pricing system for refined sugar, see Chapter VII.)

Table VI-6
Refiners' Margins in the Chicago-West
Marketing Region, 1965-74
(Dollars)

	Quoted Wholesale Price of Refined Sugar in Chicago-West Region (Per 100 Pounds)	Price of Raw-Sugar at New York Duty Paid (Per 107 Pounds)	Margin[1]	
			Current	Lagged One Month
1965	9.35	7.22	2.13	
1966	9.64	7.48	2.16	
1967	9.82	7.79	2.03	
1968	9.94	8.05	1.89	
1969	10.23	8.29	1.94	
1970	11.08	8.63	2.45	
1971	11.59	9.12	2.47	
1972				
Jan	11.69	9.74	1.95	2.23
Feb	11.90	9.65	2.25	2.16
March	11.90	9.80	2.10	2.25
April	11.90	9.51	2.39	2.10
May	11.90	9.37	2.53	2.39
June	11.90	9.38	2.52	2.53
July	11.90	9.81	2.09	2.52
Aug	11.90	9.98	1.92	2.09
Sept	11.90	10.05	1.85	1.92
Oct	11.65	9.97	1.68	1.60
Nov	11.65	9.66	1.99	1.68
Dec	11.65	9.83	1.82	1.99
1973				
Jan	11.65	10.04	1.61	1.82
Feb	11.65	9.78	1.87	1.61
March	11.55	10.11	1.44	1.77
April	11.75	10.33	1.42	1.64
May	11.87	10.76	1.11	1.54
June	11.95	10.97	0.98	1.19

Table VI-6 (continued)

	Quoted Wholesale Price of Refined Sugar in Chicago-West Region (Per 100 Pounds)	Price of Raw-Sugar at New York Duty Paid (Per 107 Pounds)	Margin[1]	
			Current	Lagged One Month
July	11.95	10.97	0.98	0.98
Aug	12.36	11.50	0.86	1.39
Sept	13.48	11.74	1.74	1.98
Oct	13.95	11.93	2.02	2.21
Nov	13.84	11.88	1.96	1.91
Dec	13.80	12.13	1.67	1.92
1974				
Jan	14.87	13.51	1.36	2.74
Feb	18.09	18.29	-0.20	4.51
March	22.12	19.38	2.74	3.83
April	23.73	20.60	3.13	4.35
May	27.07	24.66	2.41	6.47
June	31.16	28.14	3.02	6.50
July	32.25	30.33	1.92	4.11
Aug	36.30	34.88	1.42	5.97
Sept	40.74	36.07	4.67	5.86
Oct	43.59	41.53	2.06	7.52
Nov	60.90	61.31	-0.41	19.37
Dec	60.41	50.01	10.40	-0.90

[1]See footnote 3, p. 72 for some cautionary notes concerning the margin figures in this table.

Source: U.S. Department of Agriculture, Agricultural Stabilization and Conservation Service, Sugar Statistics, Vol. I, and Sugar Reports, various issues.

The data in Table VI-6 show that the margins obtained by cane refiners marketing in the Chicago-West area were substantially reduced from the latter part of 1972 to the early part of 1974. The average margin for all of 1971 was $2.47 per 100 pounds of refined sugar. In 1972 the concurrent margin varied from a high of $2.53 in May to a low of $1.68 in October. The lagged margin fell to a low of $1.60 in Octobe In 1973 the situation was even worse. Concurrent margins were below $1.00 during June, July, and August; and lagged margins were below $1.00 in July. In only one month (October) did either margin exceed $2.00. Clearly, something was causing prices to increase less rapidly than raw sugar costs. This is seen especially in the period after August 1972, when beet processors were supposedly able to impute raw material cost increases to justify price increases. It is not possible to conclude definitively that CLC regulations were responsible for these declining margins. All that can be said is that the margins did decline during the latter portion of the price controls period.

In sum, the picture appears somewhat unclear. While prices received by farmers growing sugar beets rose less rapidly than prices received by farmers growing other crops between 1970 and 1972, it is not possible to determine whether the payments to sugar beet farmers were actually higher or lower than the returns from growing other crops. In addition, prices received for sugar beets increased more rapidly than the prices received for other crops if the period 1965-72 is considered. As for the impact of the Cost of Living Council regulations, it can only be said that the price of sugar did not rise as rapidly as would have been predicted by increases in the cost of raw sugar.

VII. Wholesale Pricing of Refined Sugar

At the wholesale level, refined sugar is sold in a series of regional markets. Prices are generally determined by a delivered price system (although many, but not all, producers also offer to sell their sugar on an f.o.b. mill basis). The pricing structure in existence today is a modification of the well-known basing point system which has a long history in the sugar industry. 1/ It can be described as a freight basing point system. The price of sugar delivered to a buyer's location is equal to an area price for the pricing area in which the purchaser is located, plus a freight prepay which depends upon the cost of shipping sugar to the customer's location from the freight basing point the industry associates with that location. This freight basing point may be the location from which the sugar is shipped or it may not. All producers will use the same basing point in determining the delivered price at a location and, therefore, all producers will quote the same delivered price regardless of their location. The freight basing point may or may not be located in the purchaser's pricing area. There may be more than one freight basing point in an area. If freight charges are computed from a point outside of the region, the area price may not be representative of actual prices paid since all sales will involve substantial freight charges.

To illustrate the workings of this system, consider a sugar user located in Seattle, Washington. The entire State of Washington is in the Intermountain-Northwest region, and the freight basing point for Seattle is Crockett, Calif.--the location of California and Hawaiian's cane refinery. Thus, the price to a user located in Seattle would be the Intermountain-Northwest area price plus the freight prepay charge from Crockett to Seattle. This is the price which would be quoted by any producer regardless of where he has a plant. If the sugar is purchased from Utah-Idaho Sugar Co., which has a plant in Moses Lake, Wash. --a distance of less than 250 miles from Seattle as contrasted with a distance of about 825 miles from Seattle to Crockett--the seller would probably realize a freight gain since he would likely receive a freight prepay which is larger than his actual freight costs. 2/ On

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1/ For the historical origins of the basing point system in sugar, see Appendix B.

2/ This statement might not be true if freight prepay charges are not equal to the actual freight cost of shipping from the prepay point to the destination. It has not been possible to determine whether prepays do in fact equal transportation costs, though an official of Amstar has claimed it is true at least for his firm. (Telephone conversation with an official of Amstar Corp.)

the other hand, if the seller is Consolidated Foods Corp., which would have to ship from its plant in Southern California, actual freight costs would probably exceed the freight prepay, and Consolidated Foods would have to absorb a freight loss on the sale. 1/ In spite of this, they would quote a price equal to the Intermountain-Northwest price plus prepay from Crockett.

In addition to the Intermountain-Northwest region, there are six other generally recognized major pricing areas. These are generally identified as the Northeast, Southeast, Gulf, Southwest, Lower-Pacific, and Chicago-West regions. While there may be minor differences in the territories included in each of the seven areas, depending upon the products and firms involved, the general outline of these areas is shown in Figure VII-1. 2/ These areas have been largely unchanged for at least the last ten years and are used by the U.S. Department of Agricultu Agricultural Stabilization and Conservation Service for purposes of reporting monthly sugar prices. They are also recognized as the major pricing areas by Lamborn's Sugar Market Reports.

While the major pricing areas have remained largely unchanged, submarkets have developed in two of them. The first set of submarkets developed in the Lower Pacific region in 1967. Since then, most firms selling in this area have quoted a slightly different price for sugar sold in Arizona than for sugar sold in California and Reno and Las Vegas, Nevada. 3/ The change in pricing occurred at the same time as

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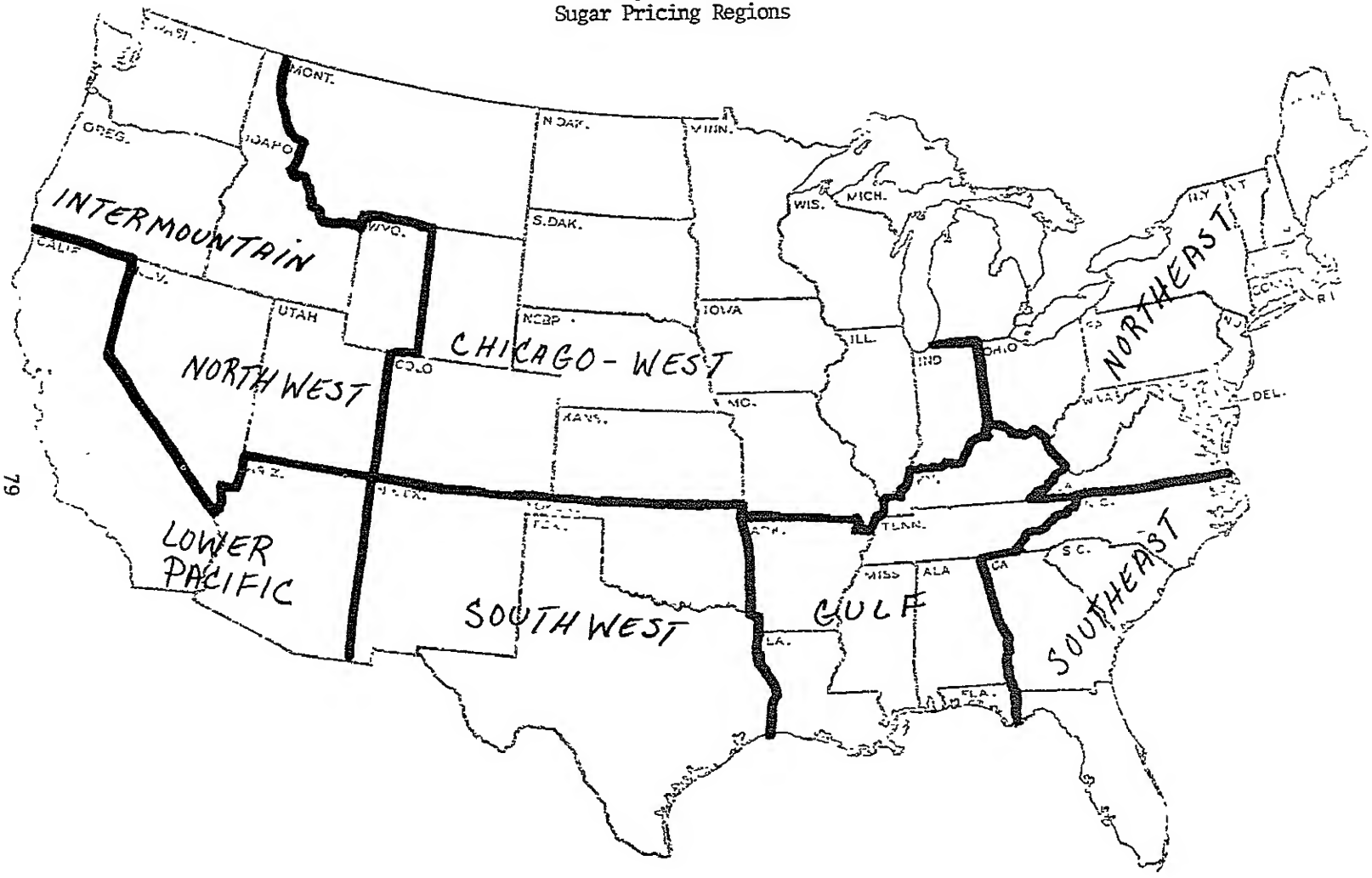
1/ This example is purely hypothetical. There is no evidence as to whether Consolidated Foods actually sells in the Seattle area.

2/ One example of differences can be found in the State of Indiana. Amstar includes Indiana in the Chicago-West region for purposes of pricing its industrial sugars, but not for grocery products. Savannah Foods and Industries includes Indiana in its Gulf pricing region. (Telephone conversations with officials of Amstar and Savannah Foods and Industries and various issues of Lamborn's Sugar Market Reports.

3/ An exception is Holly Sugar Company, which as late as 1974 was quoting the same price for California and Arizona. At the same time Holly used San Francisco as a freight basing point for the entire region. (Thurston Greene's, January 7, 1974).

Figure VII-1
Sugar Pricing Regions



a change in the freight basing points for the area. Prior to 1967 all sugar was priced at the area price plus a freight prepay from San Francisco. Since 1967, freight basing points have been the C&H plant at Crockett, the various beet processing plants in California operated by the Spreckels division of Amstar, and the Spreckels plant at Chandler, Arizona.

The second area which has developed submarkets is the Northeast. The five submarkets identified in Lamborn's Sugar Market Report and in Thurston Greene's--two trade sources which regularly quote wholesale prices--are New England, New York-Philadelphia, Baltimore-Washington, Mid-Central, 1/ and Western Ohio-Lower Michigan. These five submarkets as identified by Amstar are shown in Figure VII-2. 2/ Examination of Lamborn's suggests that the appearance of these submarkets is a fairly recent occurrence. As recently as 1970, only a single price for the entire Northeast region was reported in Lamborn's. Indeed, it is not clear that these five submarkets should be treated as distinct markets. The prices quoted for the New England, New York-Philadelphia, and Baltimore-Washington regions seem to be the same in most cases.

The location of the freight basing points and the operation of the freight prepay system is the second important aspect of the delivered price system in the sugar industry. On the east coast, freight basing points are Boston, New York, Philadelphia, Baltimore, and Savannah, Ga. New Orleans, La., Crockett, Calif., and Sugarland, Tex., are also freight basing points. Finally, Amstar's four Spreckels division plants in California and the company's plant at Chandler, Ariz., are freight basing points. Except for the Spreckels' plants, each of the freight basing points is the location of one or more cane sugar refineries. Except for the SuCrest refinery in Chicago, the Borden refinery in St. Louis, and the three small refineries in Florida, all of the cane refineries in the country are located at basing points. Beet sugar processing plants, on the other hand, are not located at freight basing points, except for the Spreckels' plants discussed previously.

As noted, some of the pricing areas used by the industry do not contain any freight basing points, and prepays are computed from freight basing points outside of the area. This is true in the Intermountain-Northwest and Chicago-West regions. While Crockett, Calif., appears to be the freight basing point for all of the Intermountain-Northwest region, it has not been possible to determine the freight basing point for all of the Chicago-West region. It appears that New Orleans is the

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1/ Referred to as Eastern Ohio, Buffalo, and Pittsburgh by Thurston Greene's.

2/ Information obtained in a telephone conversation with an official of Amstar Corporation.

Figure VII-2
Sub-Markets in Northeast Marketing Region

1- New England
2- New York- Philadelphia
3- Baltimore- Washington
4- Mid-Central
5- Western Ohio- Lower Michigan

Source: Amstar Corporation

freight basing point for a large part of this region. However, Baltimore appears to be the basing point for many shipments to Indiana, and portions of the State of Kansas may use Sugarland, Tex., as a freight basing point.

It was noted that many producers now offer to sell their products on an f.o.b. mill basis. That is, the purchaser takes possession at the seller's plant and makes his own arrangements for transporting the sugar to his location. All of the cane refiners in the nation now offer this option, as does the Spreckels' division of Amstar. 1/ Except for Spreckels, this option does not appear to be available from other beet sugar processors. 2/ It has not been possible to determine how the f.o.b. prices relate to the quoted area prices. 3/

Problems with a Freight Basing Point System

The maintenance of a rigid freight basing point system introduces a number of distortions into the economy. 4/ This pricing arrangement yields a simple set of rules which result in price equalization at each destination. The existence of such a set of rules sharply reduces the uncertainty each supplier has regarding the prices charged by his competitors. Such uncertainty is generally regarded as a necessary condition for competitive price cutting to occur. If each supplier is absolutely certain that all suppliers will adhere to the formula price, then no price cuts will occur. Prices will tend to be maintained at a higher level than would occur in the absence of complete certainty. While no system creates complete certainty, suppliers have better knowledge of competitors' prices to the extent that a basing point or freight basing point system is followed. Thus, under either of these systems, prices will tend to be maintained above the competitive level, causing the quantity demanded to be less than the competitive optimum.

Such systems are also arrangements to carry out price discrimination in an organized fashion. Users located near nonbasing point mills are discriminated against when they buy from these mills. If costs of production are the same at all mills and sellers in different regions have the same degree of market power, then a comparison of delivered prices

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1/ Telephone conversation with officials of Amstar Corporation and The Coca Cola Company.

2/ Some of the other beet processors will permit customers to pick up sugar at their plants. However, the price for such pickups is the delivered price to the customer's location less a hauling allowance. This is not the same as an f.o.b. mill price.

3/ The question of how f.o.b. mill prices are determined is particularly interesting where a plant is not located at a basing point.

4/ The discussion which follows is based on a discussion of the problems associated with a basing point system in F.M. Scherer, Industrial Market Structure and Economic Performance, Rand McNally, 1970, pp. 262-72.

near cane refineries with those near beet processing plants can be used to measure the extent of such discrimination. 1/ Discrimination also occurs in favor of buyers located at a freight basing point when they buy from sellers located elsewhere. Since the delivered price to such buyers is the price from the nearest basing point, sellers located elsewhere must incur a freight loss to make these sales. Under the assumptions of equal efficiency and competitive price determination, differences in delivered prices near basing point and nonbasing point mills again will measure the extent of such discrimination.

A rough indication of the extent of locational discrimination in the sugar industry can be obtained by looking at Figure VII-3, which shows the average delivered price for wholesale sugar in selected cities in 1965. In addition to the fact that the data are ten years old, their usefulness is diminished by the fact that it is unclear whether they are quoted or actual prices. That is, any discounting--which is alleged to be quite substantial in some areas 2/--may not be reflected in these figures. Thus, any conclusions drawn from the figures must be very tentative. 3/

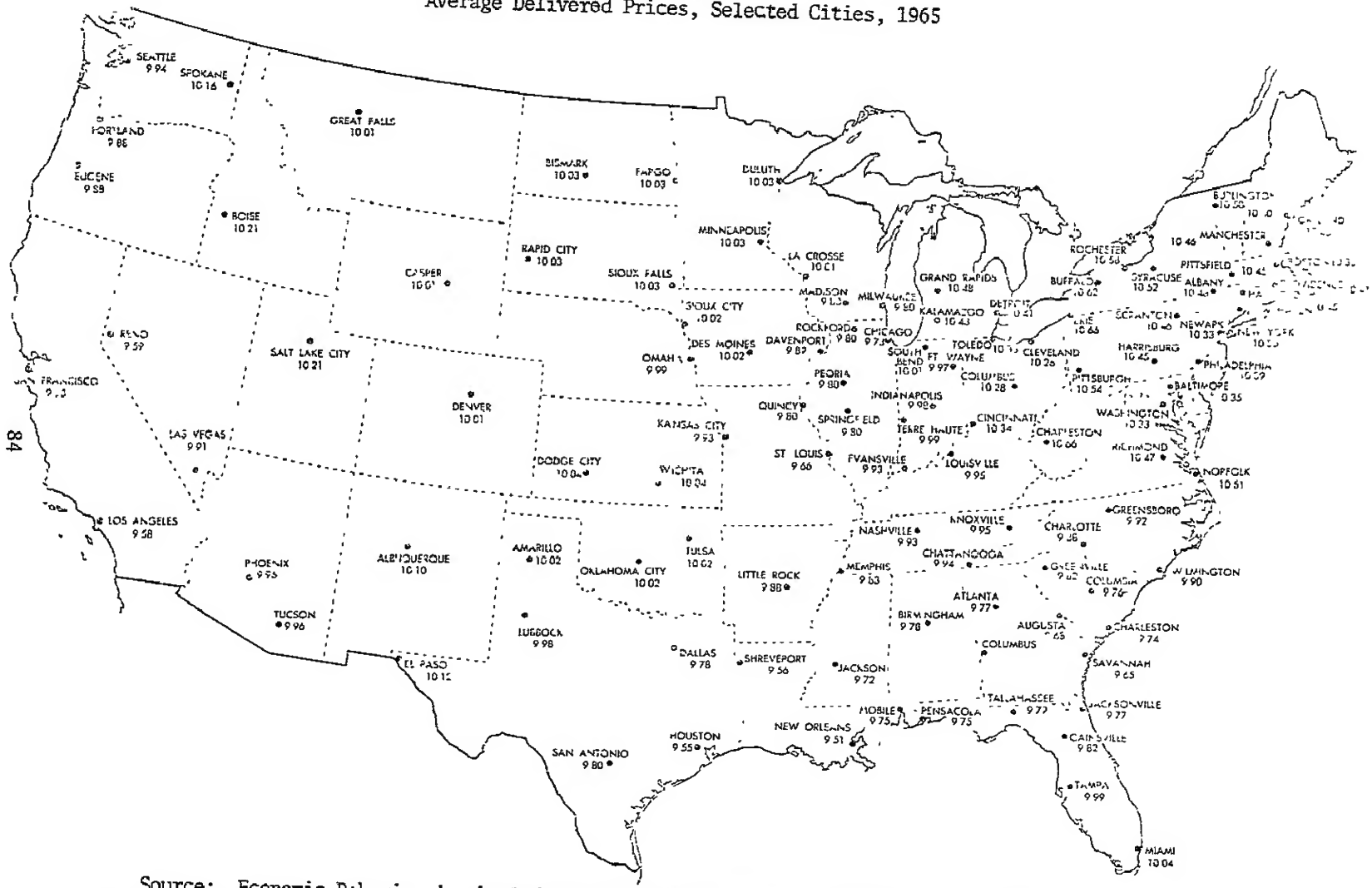
1/ These assumptions are of course not fully satisfied. The data presented in Chapter III suggest the existence of a substantial amount of market power in most regions. To the extent that differences in delivered prices are due to differences in the degree of monopoly power rather than being solely the result of the freight basing point system, the conclusions of the analysis which follows are weakened.

As for the assumption that all plants are equally efficient, an official of California and Hawaiian Sugar has suggested that it is cheaper to convert sugar beets into refined sugar than it is to convert sugar cane. This suggests that the price of refined sugar should be lower near beet processing plants than near cane refineries. On the other hand, the same official suggested that sugar beet farmers have more alternative crops they can grow than do cane growers. Thus, it may be necessary to pay a higher price for sugar beets than for sugar cane. (Interview with officials of California and Hawaiian Sugar Co.)

2/ For a discussion of discounting, particularly in the Chicago area, see F.D. Gray, "Sweetener Consumption, Utilization, and Supply Patterns in the United States: Past Trends and Relationships, and Prospects for Target Years 1980 and 2000," (Unpublished manuscript), p. 125.

3/ The only way to get an accurate picture of the pattern of delivered prices would be to obtain actual invoices from companies. Time limitations precluded this possibility.

Figure VII-3
Average Delivered Prices, Selected Cities, 1965



Source: Economic Behavior in the United States Sugar Market, University of California, California Agricultural Experiment Station, Bulletin 859, pp. 14-15.

Figure VII-3 does suggest the presence of some locational discrimination. Particularly noticeable are the prices in the states of Washington, Idaho, and Utah. These areas produce large quantities of beet sugar and yet the prices there were substantially above those in San Francisco, which is adjacent to the C&H refinery at Crockett. These high prices in the major producing areas of what is now the Intermountain-Northwest region are made all the more surprising by the fact that 71 percent of the sugar manufactured in this region in 1970 was sold in other regions. 1/

While the discrimination is not as severe, Figure VII-3 also suggests discrimination against users located in beet growing areas in the Chicago-West area. In the Rocky Mountain area, it will be noted that the price in Denver, Colo., and Casper, Wyo., were both 10.01 cents per pound while the price in San Francisco was 9.23 and that in New Orleans was 9.51. Colorado and Wyoming are both large beet sugar producing states; and therefore, this price difference is at least somewhat suspicious. Similar price differences existed between prices in the Red River Valley area of North Dakota and Minnesota--the price at Fargo, N. Dak., was 10.03 cents per pound--and the cane refinery area in New Orleans.

The final large beet producing area where a comparison can be made is the Ohio and lower Michigan area. Here again, it appears that users located in the area were not reaping the benefits of locating near the sugar producers. Prices here were substantially above those in the neighboring states of Indiana and Illinois. And, Indiana and Illinois are not large sugar producing states. Most of the sugar sold in those states must be shipped in. Thus, Figure VII-3 tentatively suggests that the freight basing point system, at least as it existed ten years ago, did result in discrimination against sugar users located near producers of beet sugar.

The presence of such locational price discrimination distorts the locational choices of sugar users. If there were no delivered price system, there would be a tendency for some buyers to locate near nonbasing point refined sugar plants. This would tend to reduce transportation costs. 2/ With a basing point system, there is no tendency to locate near nonbasing point mills. Thus, a greater than optimal geographic concentration will tend to occur at basing points. 3/ 4/

1/ See Table III-1.

2/ Other factors, such as the cost of transporting the finished good also affect locational decisions. Thus, not all sugar users would choose to locate near sugar plants.

3/ Where basing points are large urrban areas, added costs of congestion are imposed on society.

4/ Suppliers' locational decisions may also be distorted. See, Scherer, pp. 271-72.

Since a freight basing point system results in a pattern of prices that encourages suppliers located at basing points to compete for sales to users located nearer nonbasing point mills, excess hauling may be encouraged. A certain amount of interpenetration of suppliers' territories is desirable to foster competition. F.o.b. mill pricing with sporadic freight absorption would probably achieve the desirable level of such interpenetration. A basing point or freight basing point system, by encouraging added hauling, causes too many of society's scarce resources to be devoted to the transportation of the product involved. 1/

Another possible distortion arising from a freight basing point system involves the choice of transportation mode. If freight prepays are calculated on a single mode of transportation, there will be no incentive to use other modes which, in some cases, may be more efficient. Indeed, there may be strong incentives not to shift to a cheaper mode. Such a shift might tend to undermine the pricing structure as buyers would press for a share of any freight savings.

Whether or not this distortion causes serious problems in the sugar industry is unclear. Amstar claims that its freight prepays are equal to actual freight costs and that the customer is permitted to choose the transportation mode to be used in delivering the sugar. 2/ Since all of Amstar's refineries also offer an f.o.b. mill option, there should not be a major transportation mode problem as far as Amstar is concerned. However, it is not clear that this degree of flexibility is permitted in all parts of the country or by all producers.

Some additional evidence can be obtained by comparing the freight prepays charged by producers of refined sugar with the freight rates charged by the transportation companies which actually carry the refined sugar. Such comparisons of freight prepays and freight costs for five locations will be found in Table VII-1. Prepays are fairly close to actual rail rates from the controlling basing points. Whether rail is the least-cost mode in these cases is uncertain. In the case of sugar shipped from New Orleans to Chicago, the barge rate is lower than both the rail rate and the prepay. However, barge tends to be slower than rail, making this comparison inconclusive. And again, at least Amstar claims to offer a barge prepay.

Does the multiple freight basing point system hold up in the regions where a large quantity of beet sugar is produced? If prices within a pricing area always increase as the distance from the basing point or freight basing point increases, the system would appear to be effective. If, on the other hand, prices in regions which grow large quantities of sugar beets are lower than would be expected under these pricing systems, it is possible to conclude that they are not fully effective.

1/ F.o.b. mill pricing with no freight absorption would result in no territorial interpenetration.

2/ Telephone conversation with an official of Amstar Corporation.

Table VII-1
Freight Prepays and Actual Freight Rates for Shipping
Refined Sugar, November 21, 1970.
(Dollars per 100-pound bag)

Customer Location	Basing Point	Actual Freight Charge	Prepay Charged
Chicago	New Orleans - Rail	0.87	0.90
	Barge	0.38	
Toledo	Baltimore	0.78 1/	0.77
Pittsburgh	Baltimore	0.46 1/	0.44
Buffalo	Philadelphia	0.53 1/	0.49
Rochester, N.Y.	Philadelphia	0.46 1/	0.44

1/ Freight rates are rail charges from New York City to the customer location. These rates should be slightly in excess of the rates from the basing point to the customer locations listed.

Source: U.S. Department of Agriculture, Agricultural Stabilization and Conservation Service, Sugar Reports, No. 230, July 1971.

As can be seen by looking at Figure VII-3, the quoted delivered price tended to increase in each of the regions as distance from the freight basing point increased. 1/ Despite this general pattern, interesting cases, which may be exceptions, are found. In the Chicago-West region, the price at Great Falls, Mont., Casper, Wyo., and Denver (10.01 cents per pound) was almost identical to the prices at Des Moines (10.02 cents per pound) and Omaha (9.99 cents per pound) and to those for destinations in between. This is true despite the much greater distance from the former cities to New Orleans. These similar quoted prices at greater distance from the apparent freight basing point may represent a partial accommodation of the system to competition from sugar beet processors throughout this part of the Chicago-West region. 2/ Alternatively, Crockett, Calif., rather than New Orleans may be the basing point for this part of the region.

Another deviation from the prices which would be expected under a rigid freight basing point system is found in Chicago where prices were below those for the rest of the State of Illinois. This occurred in spite of the fact that such cities as Peoria, Quincy, and Springfield are closer to the controlling freight basing point of New Orleans. Lower prices in Chicago probably reflect the intense competition among sellers in this market of high demand. 1/ A cane refinery is also located in Chicago. This may put further downward pressure on price.

Relatively low prices also existed in Michigan and Ohio. For example, the price was 10.48 cents per pound in Grand Rapids and 10.28 cents per pound at Columbus, in contrast to a price of 10.47 cents per pound at Richmond, Va., which is nearer the controlling basing point of Baltimore. These pricing patterns may result from the presence of beet sugar plants in Michigan and Ohio, though as noted before, the prices do not appear to fully reflect the presence of beet processing facilities.

In sum, the evidence available at this time tentatively suggests that the delivered pricing system may introduce distortions in those regions where competitive forces are weak and sellers refuse to quote f.o.b. plant prices. This seems to be particularly true in the Intermountain-Northwest region, where the pattern of delivered prices fails to reflect the production of large amounts of refined beet sugar in the area. Similar distortions appear to exist in other major beet growing regions.

1/ For a discussion of competition in the Chicago area, see Gray, p. 125.

2/ As was previously noted, these prices are not as low as would be expected under a pure f.o.b. mill pricing system.

It is possible that the delivered pricing system may not produce serious economic inefficiencies in some other geographic areas. The degree to which such inefficiencies are absent will depend upon the degree to which the following conditions are satisfied: (1) F.o.b. mill prices are available from all producers; (2) all producers are located at freight basing points; (3) the f.o.b. prices are not greater than the delivered price minus the relevant common carrier rate; (4) the freight prepays being charged correspond closely to the freight costs via the most efficient transportation mode; and (5) competitive forces are sufficiently strong to prevent the use of the delivered price system as a collusive device.

VIII. Performance in the Sugar Industry

Previous chapters have dealt with various aspects of the structure and conduct of the sugar industry and the impact on the industry of government regulation. Little has been said about the performance of the industry. Is the industry functioning in a way that provides consumers with the desired quantity of sugar without using more resources than are necessary? Is the cost of providing this sugar falling over time or is the industry technologically stagnant? This chapter will look at three indicators of performance--profitability, extent of suboptimal capacity, and technological progressiveness. These measures do not constitute an exhaustive analysis of an industry's performance; however, they do provide some clues.

The presence of long-run profits that exceed the industry's cost of capital is one indicator of possible undesirable performance. Prices would appear to be higher than necessary, and, therefore, the product will cost consumers more than necessary. Another sign of poor industry performance is the presence of a large number of inefficiently small plants. If these plants were replaced with others of an efficient size, the cost of producing the product would fall and the good could be provided to consumers at a lower price. The final indicator of performance to be considered here is the industry's technological progressiveness. This will be considered in two aspects. First, an attempt will be made to determine the rate of technological change over time for various segments of the U.S. sugar industry. Second, the productivity of the U.S. industry will be compared with that of other countries. Clearly, it is desirable that an industry in the U.S. be as efficient as the same industry is in other countries and that it make steady progress in reducing the resources needed to produce the good.

A. Profitability

Table VIII-1 shows the rate of return on stockholders' equity from 1967 to the present for seven producers of refined sugar. Average returns for cane sugar refiners, beet sugar processors, and all refined sugar producers are also shown. Finally, data on the rates of return for all corporations primarily engaged in the manufacture of food and kindred products and for all corporations primarily engaged in manufacturing are shown for purposes of comparison.

Table VIII-1
Rates of Return on Equity from Sugar Refining
(Percent)

	1974	Rev. 1974 1/	1973	Rev. 1973 1/	1972	1971	1970	1969	1968	1967	Average	Rev. Average 1/
Amstar			15.5	24.2	8.2	9.5	12.3	9.1	7.3	8.6	10.1	11.3
Amalgamated Sugar Co.	27.0	29.6	11.1		8.9	9.6	9.3	7.7	10.4	13.4	12.2	12.5
Holly Sugar			10.8		5.8	5.0	3.0	-5.8	7.9	5.5	4.6	
Michigan Sugar Co.	33.9	41.9	2.4		2.9	10.0	7.4	6.9	9.5	14.1	10.9	11.9
National Sugar Refining Co.	-4.0	24.9	0.5		-3.1	6.8	1.2	0.6	2.5	3.9	1.0	4.7
SuCrest			-280.3	23.2	-4.2	4.5	7.5	6.5	4.6	4.8	-36.7	6.7
Utah-Idaho Sugar Co.			8.3		2.5	5.5	6.8	8.4	7.5	9.0	6.9	
Beet Processors 2/	28.2	31.8	9.7	9.7	5.9	7.2	6.7	3.9	8.8	9.6	10.0	10.4
Cane Refiners 2/	-4.0	24.9	-45.5	11.7	-3.6	5.8	4.1	3.2	3.4	4.3	-4.0	6.7
Refined Sugar 2/	22.0	30.2	8.4	17.2	5.8	8.1	9.0	6.1	7.4	8.5	9.4	11.5
Food and Kindred Products	14.0 3/		12.8		11.1	11.0	10.8	10.9	10.8	10.8	11.5	
All Manufacturing	14.9 3/		12.8		10.6	9.7	9.3	11.5	12.1	11.7	11.6	

1/ The columns headed "Rev. 1974" and "Rev. 1973" show what the company's rate of return would have been if the company had used the same inventory valuation method it used in previous years. In addition the three average return figures are computed on the assumption of no changes in accounting procedures. Reported figures are used in these calculations for firms which did not make changes.

2/ Average industry returns are weighted averages of firm returns. Firm stockholders' equities are used as weights.

3/ These figures are not fully comparable with figures for previous years, due to changes in the FTC's Quarterly Financial Statistics Program. The changes along with measures of their impact can be found in Federal Trade Commission, Quarterly Financial Report for Manufacturing, Mining, and Trade Corporations, Fourth Quarter 1974.

4/ Company data are for fiscal years and are reported under the calendar year which contains the most months of the fiscal year.

Sources: Moody's Industrial Reports, Company Annual Reports, and FTC Quarterly Financial Reports.

The seven firms included in the table were selected because all or almost all of their production is refined sugar and because their financial data are readily accessible. These seven firms account for almost half of total national sales. Among the firms included is Amstar, the largest sugar refining company in the country, which accounts for approximately 27 percent of national sales. Also included are the fifth, sixth, and ninth largest firms in the industry. Since these firms are not highly diversified, the reported figures can be taken as a fairly accurate measure of the profitability of manufacturing sugar. However, the lack of data for firms which make the remaining half of total sales decreases the usefulness of the reported data as a measure of industry profitability.

In computing average rates of return for cane refiners, the problem of incomplete data was particularly serious. The data for cane refiners are based on the performance of National Sugar Refining Co. and of SuCrest, the fourth and seventh largest cane refining firms, respectively. 1/ These two firms account for only 12 percent of cane sugar sales. Thus, these data should be used with extreme caution. The data for beet processors are somewhat more reliable as there are four firms included in this average. These firms rank third, fifth, sixth and eigth among beet processors and account for about forty percent of beet sugar sales.

During 1973 and 1974 fiscal years, 2/ five of the seven firms changed their methods of valuing inventories. All five adopted the last in, first out (LIFO) method for valuation of their raw sugar and/or refined sugar inventories. Previously, three of the firms--SuCrest, National Sugar Refining, and Michigan Sugar Co.--had used the first in, first out (FIFO) method of valuation. Amstar and Amalgamated Sugar Co., had previously employed an average cost approach. The two firms not changing valuation methods already employed the LIFO method.

1/ Since Amstar makes both cane and beet sugar, its data could not be used in computing separate profitability figures for the two methods of production.

2/ A company's 1973 fiscal year is that fiscal year which contains the most months of calendar year 1973. That is, fiscal years ending between July 1, 1973, and June 30, 1974, are reported as 1973 fiscal years.

As shown in Table VIII-1, the change in accounting methods caused the companies' reported rates of return to be lower than they would otherwise have been. The decrease in profit rates ranged from 2.6 percent for Amalgamated to 303 percent for SuCrest. Without inventory valuation changes, sugar producers would have earned an average rate of return of 17.2 percent on stockholders' equity in 1973. For those companies which have already reported for 1974, the rate would have been 30.2 percent. With the changes, the average rates were 8.4 and 22.0 percent, respectively.

The obvious question at this point is which set of figures is more meaningful? Clearly, if one wishes to compare the most recent data with those for earlier periods, the data which use the old inventory valuation method are the appropriate ones. Beyond this point, however, it is more difficult to make clear-cut statements. If one is primarily interested in the profits made in the manufacturing process rather than the profits or losses from holding inventories, the LIFO method would appear to be preferable. Since the charge for a good taken from inventory is equal to the price paid for the last unit purchased under a LIFO system, this charge should approximate the current price. However, the costs appearing on the income statement will include costs associated with the carrying of inventories as well as manufacturing costs. Also, the asset value of inventories held will be below the replacement cost of the inventories. In a time of inflation, these problems will, in most cases, cause the ratio of profits to stockholders' equity to have a larger absolute value than would the return from manufacturing alone with all costs and inventories stated in current prices.

If one is interested in evaluating the overall profitability of an operation, it may be more meaningful to look at figures which use a FIFO or an average cost approach to inventory valuation. Under these systems, the charge for using a unit of inventory will be lower than the replacement cost if prices are rising. The difference between the current replacement price and the charge made plus any costs of holding the inventory is a profit earned by holding the inventory rather than buying each unit as it is used. The difference between the price for which the finished good is sold and the various costs of manufacture--including replacement cost of materials taken from inventory--is the profit earned on the manufacturing operation. These two amounts are added together in the figures reported under a FIFO or an average cost approach. Therefore, the resulting figures reflect the profitability of both activities. If prices are rising, these profits will be larger than the profitability of the manufacturing operation alone.

What conclusions can be drawn about profitability in the sugar industry? Quite clearly profits have risen in the latest reporting year for each company. This would appear to correspond with the increases in sugar prices. 1/ For all years prior to 1973 average profitability in the industry ran below that of Food and Kindred Products and All Manufacturing. This suggests that sugar refining was not a particularly profitable activity and that one should not expect a large flow of new capital into the industry. Finally, while the earlier discussion indicates that these data may not be too reliable, it appears that beet processors had higher profits during the period than did cane refiners. 2/

B. Extent of Sub-Optimal Capacity

Another measure of industry performance is the percentage of capacity accounted for by plants of less than minimum efficient size. If an industry is operating with many inefficient plants, its costs will be higher than necessary, thus causing consumers to pay higher prices for the goods being produced. 3/ A large amount of inefficient capacity should not be found in a competitively functioning industry where entry is not restricted. In such an industry efficient-sized plants would continue to be built either by existing producers or by new entrants until demand for the product could be satisfied by the efficient plants. Consequently, the price of the product would fall to a point where inefficient plants would be forced to shut down.

What is the extent of sub-optimal capacity in the sugar industry? In the cane refining process there does not appear to be a significant amount of such capacity, though the data on minimum efficient size are not very good. It was noted in Chapter III that the most recently constructed plants are among the smallest refineries in existence. This at least suggests that all of the existing plants are large enough to be efficient.

1/ Fiscal years for Amstar and SuCrest end on June 30. Thus, the increase in their 1973 profits could be associated with the rising prices during the first six months of calendar year 1974.

2/ This does not mean that the production of beet sugar is more efficient than the production of cane sugar. These data do not consider the returns to cane or beet growers or to cane grinders.

3/ The fact that a plant is large enough to be efficient does not, of course, imply that it is efficient. Factors other than small size can also be responsible for inefficient operation.

The beet sugar processing sector seems to operate a large number of inefficient-sized plants. The minimum efficient size for a beet processing plant is estimated at between 4,000 and 5,000 tons of beets sliced per day. 1/ Using the 4,000 ton figure, 33 out of 53 plants operating in 1972 were too small to be efficient. These plants accounted for 44.5 percent of the sugar beet processing capacity in operation. Since that time there has been some improvement in the situation as one of the inefficient plants has been closed, several new plants of minimum efficient size or greater have been or are being constructed, and expansion plans for existing plants have been announced.

Low returns from beet processing and acreage limitations due to the Sugar Act appear to have contributed to the large number of inefficient plants. The way the returns from the sale of beet sugar have been divided between growers and processors has resulted in low returns for the processors. Hence, processors have been unwilling to invest the capital necessary to increase capacity. Without new investment it has not been possible to expand existing plants to minimum efficient size or to build new plants. And, there were not enough minimum efficient sized plants to satisfy total demand. Thus, price and cost remained higher than what was technologically possible.

Another problem limiting the amount of rationalization in the industry's productive capacity has been acreage limitations imposed by the Sugar Act. As previously discussed, a new, efficient-sized plant would require 50,000 acres of beets to operate efficiently. However, the Secretary of Agriculture would often not grant acreage allotments of that size to a new plant. The inadequate supply of beets rendered the building of new plants unprofitable. 2/

C. Technological Progressiveness

It is generally agreed that no major technological innovations in the processes by which refined sugar is obtained from sugar beets and sugar cane have occurred in the present century. Within the limits imposed by these fixed technologies, numerous process improvements have been made. Many of these improvements have involved the mechanization of tasks formerly carried out by labor. Other changes have taken the form of larger and improved boilers, evaporators, and other equipment. Finally, computerized control of product quantities and qualities has been installed in some plants and refineries. Thus, while the vintage of refined sugar manufacturing facilities tends to be quite old, a significant amount of modernization and expansion has occurred in at least some of these facilities. 3/

One possible indicator of the technological progress that has occurred in an industry is the rate of change in output per man-hour. While this is one of the most commonly used measures of technological

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1/ See Chapter III.
2/ See discussion in Chapter III.
3/ Interviews with officials of California and Hawaiian Sugar Company and Amstar Corporation.

progress and will be used here, it is only a rough indicator. Ideally, one should measure the efficiency of use of all factors of production rather than labor only. Changes in labor productivity are a reasonable proxy for changes in total factor productivity if the relative prices of the various factors of production (e.g., labor and capital) have not changed significantly over the period being studied. In the sugar industry there has been a 173 percent increase in the average hourly earnings of production workers during the period 1950 to 1972. 1/ During the same period, the cost of capital goods increased by 450 percent. 2/ Thus, relative factor prices have not remained constant and increases in output per man-hour may reflect changes in factor intensities as well as true technological progress.

Data on output per man-hour are presented in Table VIII-2. This table gives data for the entire sugar industry, which includes cane grinding, cane sugar refining, and beet sugar processing. Data for the entire manufacturing sector of the economy are provided for comparison purposes. These data are index numbers with 1967 set equal to 100. Also included in the table are rates of change for these index numbers. Over the period 1950 to 1973, the rate of increase for the sugar industry was 4.1 percent. This compares with an all manufacturing rate of increase of only 3.0 percent. 3/ Thus, productivity in the sugar

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1/ Based on data on average hourly earnings of production workers in establishements classified in SIC industry 206 as reported in U.S. Bureau of Labor Statistics, Employment and Earnings: United States 1909-1972, p. 365, and Employment and Earnings, 21 (December, 1974), p. 158

2/ Based on a 97 percent increase in the wholesale price index of machinery and equipment and a 180 percent increase in a five-year average of interest rates on corporate bonds with a Moody's rating of Aaa. The price index data were taken from U.S. Bureau of Labor Statistics, Handbook of Labor Statistics, 1974, p. 331. Interest rates are from Economic Report of the President, 1975, p. 318.

To the extent that increases in machinery and equipment quality are not fully accounted for, the wholesale price index is somewhat biased upward. The extent of this bias is probably not large enough to affect the conclusions of this section.

3/ The problem of changes in relative factor prices is present in the all manufacturing data also. The average manufacturing wage rose by 165 percent between 1950 and 1972 while capital goods prices rose 450 percent. (Average hourly earnings for production workers in manufacturing establishments from Handbook of Labor Statistics, 1973, p. 230. For the source on capital data, see note 2 above.) The fact that shifts in relative factor prices were approximately the same in all manufacturing and in sugar probably makes the comparison of rate of change data more meaningful.

Table VIII-2
Indexes of Output Per Man-Hour, 1947-73
(1967 = 100)

Year	Sugar	All Manufacturing
1947	42.9	54.9
1948	N.A.	58.0
1949	47.3	60.1
1950	50.7	64.4
1951	47.4	65.9
1952	51.1	66.2
1953	53.0	68.4
1954	58.3	69.5
1955	60.3	73.7
1956	63.5	72.9
1957	62.7	74.4
1958	64.8	74.4
1959	68.4	78.6
1960	72.2	79.9
1961	77.5	81.9
1962	85.2	86.6
1963	86.2	90.1
1964	91.1	94.5
1965	95.3	98.4

Table VIII-2 (continued)

Year	Sugar	All Manufacturing
1966	99.5	99.9
1967	100.0	100.0
1968	104.3	104.7
1969	102.0	107.4
1970	111.1	108.0
1971	111.0	115.6
1972	117.9	121.8
1973	114.6 P	127.5
Rates of Change[1]		
1950-73	4.1%	3.0%
1960-73	3.4	3.4
1965-73	2.5	3.3

[1]Average annual percent change based on the linear least squares regression of the logarithms of the index numbers against time.

[P]Preliminary

Sources: (1) Sugar data from U.S. Department of Labor, Bureau of Labor Statistics, Indexes of Output Per Man-Hour: Selected Industries, 1974 Edition.

(2) All Manufacturing data from U.S. Department of Labor, Bureau of Labor Statistics, Handbook of Labor Statistics, 1974.

industry rose more rapidly than productivity in manufacturing in general over the 23-year period. This higher level appears, however, to have occurred primarily in the 1950's and early 1960's. For the period 1965-73, the rate of increase for the sugar industry was only 2.5 percent while the all-manufacturing rate was 3.3 percent.

As noted, the data in Table VIII-2 are for the combined performance of three distinct processes. Data are available which allow separate analyses of the various parts of the sugar industry. The Sugar Division in the Department of Agriculture has collected data on sugar beet processing and on sugar cane grinding for selected years. These data include man-hours per hundredweight of refined sugar--the inverse of the output per man-hour figures used above--and capital per hundredweight of refined sugar. These figures were provided on a national basis for sugar beet processing and separately for the four regions which grow sugar cane--Florida, Louisiana, Hawaii, and Puerto Rico. The data for beet sugar is given in Table VIII-3 and the data for sugar cane grinding in Table VIII-4.

In addition to considering changes in output per man-hour, an attempt was made to remove the effects of changes in the capital-labor ratio from the measure of changes in productivity. In order to do this, a Cobb-Douglas production function with a constant rate of neutral technological change was estimated for each of the two processes. 1/ As with the output per worker-hour measure, this analysis does not provide an exact measure of technological change. The analysis assumes a specific form for the production function, and there is no strong reason to believe this is the correct form. To the extent that the production process does not conform to the Cobb-Douglas model, the resulting estimates of the rate of technological change will be in error. In drawing conclusions, then, both the rate of change in output per man-hour and the rate of change in the Cobb-Douglas production function data should be seen as indicators of the behavior of the industry, and not as exact values.

1/ The form of the Cobb-Douglas production function with constant neutral technological change is

$$Q = Ae^{\sigma t} K^{\beta} L^{\gamma}$$

where

Q = quantity of output
K = capital stock used in producing the output
L = labor used in producing the output
t = time.

Table VIII-3
Man-Hours and Total Investment Per Hundred
Pounds of Refined Beet Sugar

Crop Year	Total man-hours per cwt.	Total investment per cwt.
1950	.736	$5.383
1951	.819	7.191
1953	.607	6.584
1954	.603	6.329
1955	.636	7.082
1957	.535	6.051
1958	.529	6.294
1959	.559	6.109
1962	.465	6.715
1963	.443	6.462
1964	.417	6.566
1966	.405	8.624
1967	.428	8.982
1968	.357	7.465
1970	.385	8.696
1971	.360	7.696
1972	.354	8.440

Source: Sugar Division, U.S. Department of Agriculture.

Table VIII-4
Man-Hours and Total Investment Per Hundred
Pounds of Raw Cane Sugar

Crop Year	Total man-hours per cwt.	Total investment per cwt.
Florida		
1956	.398	$3.39
1957	.414	2.75
1958	.381	3.90
1960	.356	3.897
1961	.337	6.924
1962	.332	7.821
1964	.322	6.903
1965	.309	7.213
1966	.254	6.921
1967	.238	8.074
1968	.264	9.712
1969	.278	9.405
Hawaii		
1950	.782	$3.259
1951	.747	3.013
1952	.727	2.950
1955	.566	2.173
1956	.559	2.308
1957	.524	2,495
1959	.506	2.831
1960	.482	2.851
1961	.403	2.434
1964	.357	2.517
1965	.361	2.676
1966	.352	2.805
1967	.359	3.176
1968	.340	3.107
1969	.325	3.432

Table VIII-4 (continued)

Crop Year	Total man-hours per cwt.	Total investment per cwt.
Louisiana		
1952	.772	$3.110
1953	.782	3.025
1954	.742	3.320
1956	.617	3.951
1957	.709	4.419
1958	.570	3.628
1960	.540	4.113
1961	.419	3.378
1962	.485	4.344
1965	.550	5.457
1966	.487	5.516
1967	.446	4.282
1969	.421	6.893
1970	.413	6.106
1971	.471	6.616
Puerto Rico		
1951	.765	$3.65
1952	.725	3.56
1953	.745	4.17
1954	.714	4.59
1956	.623	5.11
1957	.610	5.65
1958	.601	6.20
1960	.510	4.56
1961	.482	3.77
1962	.468	4.18
1963	.520	3.67
1964	.510	4.25
1965	.460	4.65
1969	.598	8.28
1970	.670	8.00
1971	.820	8.28

Source: Sugar Division, U.S. Department of Agriculture.

For beet sugar processing, the rate of technological progress for the period 1950 to 1972 was estimated at 2.9 percent using the Cobb-Douglas approach. Using the output per man-hour approach it was 3.5 percent. Estimates for the periods 1960-72 and 1965-72 were also made using the output per man-hour approach. These estimates were 2.5 percent and 2.4 percent, respectively. Thus, it appears that the rate of change for the entire period was between 2.9 and 3.5 percent. This is somewhat less than the rate of change for the entire sugar industry, though probably marginally higher than that for the entire manufacturing sector. As with the combined sugar industry, there appears to have been a decline in the rate of technological progress in the 1960's and early 1970's.

In sugar cane grinding the estimate of progress was 5.9 percent using the production function approach and 3.9 percent using the output per man-hour approach. In both cases, the estimates are based on a pooling of the data for the Florida, Hawaii, and Louisiana regions. Puerto Rico was excluded because there has been a substantial decline in sugar cane growing in that area. 1/ Because of this, it is expected that there is a substantial amount of excess capacity in the area and this could reduce the usefulness of the resulting data. The data for Florida, Hawaii, and Louisiana were combined, since the operations being carried on in each region are the same and there is no reason to expect different technologies in different regions, though a quick glance at the data suggest that different regions were operating with different capital-labor ratios. This is probably the result of interregional differences in relative factor prices and interregional differences in

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1/ In 1962, 1,009,000 tons of 96° raw sugar were produced in Puerto Rico; by 1971 the figure had fallen to 324,000 tons (U.S. Department of Agriculture Stabilization and Coservation Service, Sugar Statistics, Vol. II, and Sugar Reports.)

the growth of the industry. 1/ Additionally, interregional differences for specific years may be the result of different degrees of capacity utilization because of the success or failure of the cane crop in that region.

Compared to the 3.9 percent rate of technological change for the entire period using the output per man-hour approach, the estimate for the period 1960-72 was 2.5 percent and that for 1965-72 was 2.7 percent. 2/ Based on these data, it appears that the rate of progress in cane grinding has been about equal to that in the sugar industry generally, except for the period 1960-65, when progress in grinding seems to have been slower than for the rest of the industry. The data also suggest that productivity increases in grinding were higher than for all-manufacturing. Rates of change in output per man-hour were also estimated for each region separately. Hawaii had the largest annual increase

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1/ Louisiana has a lower capital-labor ratio than either Florida or Hawaii. This appears to be the result of lower wage rates in Louisiana. In 1969, the cost of an hour of labor was $2.68 in Louisiana, $3.60 in Florida, and $3.63 in Hawaii. (Labor unit costs were derived from data on labor cost per hundredweight of raw sugar produced and man-hours per hundredweight of raw sugar. These figures were taken from U.S. Department of Agriculture, Agricultural Stabilization and Conservation Service, Returns, Costs, and Profits- Louisiana 1969-71 Crops: Sugar Cane Production and Processing; Returns, Costs, and Profits- Florida 1967-69 Crops: Everglades Area: Sugar Cane Production and Processing; and Returns, Costs, and Profits of Hawaiian Sugar Plantations 1967 to 1969 Corps.)

The apparent higher capital-intensity of sugar cane grinding in Florida as compared to Hawaii is a little harder to explain, since wage rates are practically the same in the two regions. One explanation may be that the cost of capital is higher in Hawaii, since most capital goods must be shipped from the mainland. A second explanation may be found in the higher rate of growth in sugar production in Florida. This suggests that the capital equipment in Florida is newer than that in Hawaii. The same piece of capital equipment undoubtedly costs more today than it did twenty years ago.

2/ All three of these figures were estimated by a least squares technique that took into account the fact that different regions had different levels of output per man-hour in the initial period.

with a rate of 4.7 percent; Florida had a rate of 3.8 percent; and Louisiana, a rate of 3.2 percent. 1/

For the cane refining portion of the sugar industry, data on man-hours per unit of output and capital per unit of output are not available; therefore, it was not possible to estimate technological progress by the production function approach. However, the Sugar Division does publish data on production of refined cane sugar, and the Bureau of the Census publishes data on total production man-hours worked. Both of these data items are available for the period 1960-72 and, therefore, output per man-hour estimates can be computed for that period. The figures are shown in Table VIII-5. They are probably an overstatement of true output per man-hour because of a discrepancy between the output and man-hour data series. 2/ The extent of the bias would appear to be in the neighborhood of seven to nine percent.

Using the available data, the rate of increase in output per man-hour for the period 1960-72 was estimated at 4.1 percent. The rate for 1965-72 was 2.2 percent. Therefore, the rate of progress in cane refining would appear to be above that for all sugar manufacturing and for all manufacturing for the former period. However, the 4.1 percent figure may overstate the true rate of change. As noted elsewhere, Glades County Sugar Growers Cooperative opened a new refinery and grinding mill in Moore Haven, Florida, during the early 1960's. This plant accounts for about 1.5 percent of total cane sugar refining capacity, and its opening would have biased the rate of change figures, since its employment would not be included in the man-hour figures for the reasons discussed before. Correcting for this problem, the true rate of change is probably in the neighborhood of 2.5 to 3.0 percent.

1/ An attempt was made to estimate separate production functions for the various growing regions. This effort was unsuccessful, as estimated capital coefficients in two of the regions were negative. This does not make economic sense and suggests that Cobb-Douglas may not be the proper form for the production function in the industry. Another possible explanation is that the data for a single region do not show enough variation in equilibrium conditions to provide adequate estimates.

2/ The Bureau of the Census does not include plants which both grind sugar cane and refine raw sugar in their figures for SIC 2062, Cane Sugar Refining. Thus, employment at these plants is not included in the man-hours worked series. The Department of Agrigulture includes sugar produced in such plants in its production figures.

Table VIII-5
Output per Man-Hour in Cane Sugar Refining

Year	Output (Short tons, raw value)	Man-Hours (Millions)	Output Per Man-Hour
1960	6,499,098	24.4	0.266
1961	6,631,325	22.5	0.295
1962	7,046,822	21.7	0.325
1963	6,872,869	20.7	0.332
1964	6,578,767	19.2	0.343
1965	6,813,109	17.9	0.381
1966	7,152,336	17.8	0.402
1967	7,348,501	18.7	0.393
1968	7,713,686	18.2	0.424
1969	7,355,278	17.8	0.413
1970	7,642,528	16.7	0.458
1971	7,837,209	17.6	0.445
1972	7,814,894	18.0	0.434

Sources: Output data from U.S. Department of Agriculture, Sugar Statistics, vol I; and Sugar Reports. Man-Hours from Bureau of the Census, Preliminary Report 1972 Census of Manufactures, Cane Sugar Refining, SIC 2062, Table I.

D. International Productivity Comparison

The industrial performance of other developed countries provides a yardstick by which the performance of U.S. industry can be evaluated. Of particular interest in this section is the efficiency with which U.S. industry employs scarce resources compared to industrial efficiency in other countries. Available data do not permit accurate measurement of productivity in different countries on a common basis. Differences in industry definition, data collection conventions, resource endowments, and social institutions make the data of different countries less than perfectly comparable. However, it is possible to develop rough impressions of the relative efficiency of a given industry, in this case the sugar industry, in the U.S. and other countries by looking at output per man-hour figures. As noted before, these figures are more useful if relative factor prices are the same for all observations. In international comparisons this means that relative factor prices must be the same in all of the countries being studied. It is also necessary that all of the countries use the same technology. Empirical studies of industrial organization suggest that these assumptions will work as a reasonable first approximation in North America and Europe. 1/

Table VIII-6 presents the productivity of labor for the U.S. and Canadian cane sugar and beet sugar industries. It is desirable to disaggregate to this level since different production processes are used to obtain refined sugar from raw sugar and from sugar beets. Consistent with this difference are the marked differences between labor productivity in beet and cane sugar production. In the U.S., labor productivity in cane sugar production is approximately three times that in beet sugar production. In Canada, the ratio is between two and three in favor of cane sugar labor productivity. 2/

1/ See, F. M. Scherer, et al., The Economics of Multi-Plant Operation: An International Comparisons Study, Harvard University Press, forthcoming, Chapter 4.

2/ The greater labor productivity in cane refining may be due in part to the fact that beet sugar production starts with unprocessed beets, while cane sugar refining uses semiprocessed raw sugar as its major material input. Thus, no conclusions can be drawn from this difference as to the overall efficiency of producing refined sugar from sugar cane versus sugar beets. Data to make such an overall comparison are not available.

Table VIII-6
Productivity of the U.S., Canadian, and Swedish Sugar Industries

Year		Refined Sugar Production (Thousand Kilograms)			Production Man-Hours (Thousands)			Output Per Man-Hour (Kilograms)		
		Cane	Beet	Total	Cane	Beet	Total	Cane	Beet	Total
1969	U.S.	6,198,990	2,752,165	--	17,800	24,000	--	348	115	--
	Canada	856,692	128,011	--	3,639	1,130	--	235	113	--
1968	U.S.	6,502,332	2,578,488	--	18,200	21,700	--	357	119	--
	Canada	845,933	109,923	--	3,761	1,342	--	225	82	--
1967	U.S.	6,192,419	2,315,397	8,507,816	18,700	20,300	39,000	331	114	218
	Sweden	114,303 a/	178,113	292,416	N.A.	N.A.	2,941	N.A.	N.A.	99
1966	U.S.	6,032,699	2,402,379	8,435,078	17,800	20,200	38,000	339	119	222
	Sweden	N.A.	N.A.	280,306	N.A.	N.A.	3,143	N.A.	N.A.	89

N.A. - Not available

a/ Refined from raw sugar. Raw sugar is either imported raw cane sugar or raw beet sugar from a domestic beet processing plant.

SOURCES: U.S. Department of Agriculture, Agricultural Stabilization and Conservation Service, Sugar Reports, various issues.

U.S. Bureau of the Census, Annual Survey of Manufactures, Industry Profiles, 1970.

Statistics Canada, Productivity Trends in Industry, Catalogue 14-506, occasional.

Statistiska Centralbyrån, Industri, 1967, Sveriges Oficiella Statistik, 1969.

Comparing the data for the two countries, there appears to be no significant difference between the U.S. and Canadian beet sugar industries. The virtual equality of labor productivity in 1969 suggests that the poor Canadian performance in 1968 may have been due to special circumstances in that year. The apparent U.S. superiority in cane sugar requires some qualification. The Canadian productivity data are understated due to the method of measuring man-hours. In Canada, man-hours are measured on an hours-paid basis, rather than the hours-worked basis used in U.S. data. Hours paid will tend to exceed hours worked because of paid vacations, holidays, and sick and other leaves. It is estimated that the use of hours paid biases the Canadian productivity data downward by less than 15 percent. 1/ The U.S. data, on the other hand, are overstated by seven to nine percent due to the exclusion of labor in plants producing both raw and refined cane sugar from the man-hour data. 2/ Making allowance for these biases, the U.S. superiority of 48 percent in 1969, and 59 percent in 1968, is reduced by about 25 percentage points in each year. Thus, we can tentatively conclude that the U.S. cane sugar industry was about 23 percent and 34 percent more productive than its Canadian counterpart in 1969 and 1968, respectively.

The second country for which comparisons are made is Sweden. Swedish data are not disaggregated into separate cane and beet sugar employment figures. This poses a problem since output per man-hour appears to be higher in cane refining than in beet processing. The aggregated number is a weighted average of output per man-hour in the cane refining sector and output per man-hour in the beet processing sector. The weights are the fraction of total man-hours which are employed in each sector. If the weights for Sweden are different from those for the U.S., the aggregate values for the two countries will not

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1/ Paid vacations longer than four weeks are offered by only 28 percent of the reporting units in Canadian manufacturing. Paid vacations of four weeks after less than 14 years of service are offered by only 4 percent of these units. Paid holidays of 11 days or more are available in only 3 percent of the reporting units in Canadian manufacturing. Hence, a four-week paid vacation is a rather liberal estimate of the average vacation in Canadian industry. Adding another three weeks for holidays and leaves gives a bias of about 14 percent to the Canadian data. (Telephone interview with E. Beaulieu, Economics and Research, Labour Canada; and Working Conditions in Canadian Industry, Report No. 13, Economics and Research, Labour Canada, 1969.) Given the seasonal nature of beet sugar production, hours paid is probably a reasonable approximation of hours worked in that industry.

2/ See above, p. 102.

be comparable. In fact, beet sugar production is more important in Sweden than it is in the United States. 1/

In spite of this problem, it is possible to conclude that the Swedish industry is no more efficient than the U.S. industry. Table VIII-6 shows that the beet processing part of the U.S. industry has greater output per man-hour than the total Swedish industry. Even if Sweden produced only beet sugar, this would suggest that the U.S. industry is the more efficient. However, Table VIII-7, which identifies all of the refined sugar producing plants in Sweden, shows that there is one small plant which refines some imported raw cane sugar. 2/ Since the presence of this refinery tends to raise the Swedish weighted average labor productivity, the Swedish industry appears to be even less efficient. 3/

From the evidence presented here, the U.S. sugar industry seems to be relatively efficient. The U.S. and Canadian beet sugar industries appear to be about equally productive. The productivity of the U.S. cane sugar refining industry was observed to be greater than that of its Canadian counterpart. Finally, the U.S. sugar industry is more efficient than that of Sweden.

1/ At present, it is not possible to be more precise on this point. The capacity data for Swedish cane and beet sugar in Table VIII-7, are on a daily basis as are the U.S. data in Table IV-4. While Swedish beet plants operate about 70 days per year (see source of Table VIII-7), some U.S. plants work nearly year round. The number of working days of the Swedish refining plant is not known.

2/ Since the beet plants only operate about 70 days per year while the refinery operates more days and also refines some raw beet sugar, these data do not show the percentage of output that is cane and the percentage that is beet.

3/ It is interesting to note that the percentages of refined beet sugar capacity which are sub-optimal in each country are very close. In Sweden 46.5 percent of refined beet sugar capacity is sub-optimal, while in the U.S. 44.5 percent was less than minimum optimal size in 1972. Since information on the product mix of Sweden's sugar refinery is not available, it is not known whether this refinery achieves minimum efficient size.

Table VIII-7
Daily Capacities of Swedish Refined Sugar Plants, 1968

Plant	Type	Capacity 1/ (metric tons)
Mörbylånga	Beet Processing Plant	2,100
Roma	"	1,700
Karpalund	"	2,100
Hosslarp	"	3,300
Köpingebro	"	5,500
Örtofta	"	5,100
Arlöv	Refinery 2/	700

1/ Beet sugar plant capacity in beets sliced. Cane refinery capacity in raw sugar melted.

2/ Raw sugars refined are imported raw cane sugar and raw beet sugar from a domestic beet processing plant.

SOURCE: Statens offentliga utredningar, 1970: 30, Finans - departmentet, Stordriftsfördelar inom industri produktionen, Koncentrationsutredningen VII, 1970, p. 359.

Appendix A: Production Processes

A. Cane Sugar: 1/

Sugar cane is a tall grass which may grow to a height of 15 to 18 feet. It grows in a warm, moist climate. Domestically, cane is grown in Florida, Louisiana, Hawaii, Texas, and Puerto Rico. Sugar cane is also grown in 31 foreign countries located mainly in east and southeast Asia, Africa, the tropical Pacific islands, and South and Central America. Because of its bulk and because the sugar content of the cane tends to fall rapidly if it is not ground soon after harvesting, sugar cane is not imported. However, raw sugar--the output of the grinding mill--is traded internationally. In 1974, 71.6 percent of the raw sugar received by domestic cane refineries was imported. 2/

The stalk of the sugar cane is divided into sections by joints, each containing a bud or "eye" which will sprout if planted. Stalk sections are planted by dropping them lengthwise into furrows. The planting season in Louisiana begins in late July or August and ends in September or early October. In Florida, the planting season is September and October. In Hawaii, cane is planted all year round. 3/ Once planted, the sugar cane will produce more than one crop. In Louisiana, a single planting will produce three crops; thus, one-third of the acreage under cultivation is replanted each year. 4/ In other regions, a planting may yield more than three crops.

The harvesting season varies from region to region depending in large part on weather conditions in the region. In Louisiana, the crop must all be harvested prior to the first freeze. For this reason,

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1/ The description of these operations was obtained from Robert R. Nathan Associates, Cane Sugar Refining in the United States; Michele Bailliet Francois, "Federal Regulations, Processing Costs and Scale of Plant in the Louisiana Sugar Cane Industry," unplublished Ph.D. dissertation, Tulane University, 1971; and a visit to the California and Hawaiian Refinery in Crockett, Calif.

2/ United States Department of Agriculture, Agricultural Stabilization and Conservation Service, Sugar Reports, No. 273, February 1975, p. 9.

3/ U.S. Department of Agriculture, Agricultural Stabilization and Conservation Service, Sugar Statistics, Vol. II, Revised February 1969, p. 78.

4/ Francois, p. 38.

harvesting begins around the middle of October and is finished by late December. 1/ In Florida, harvesting begins in November and ends in April or May. In Hawaii, sugar cane is harvested year round. In harvesting, the cane stalk is cut close to the ground; the tops are lopped off and then the leaves are cut from the stalk. Finally, the stalks are cut into convenient lengths for transportation to the raw sugar mill. In some areas, the cane fields are set afire before harvesting to destroy the leaves. The cane itself is left intact because it contains a large amount of moisture.

One type of mechanical harvester draws the cane into jaws as it advances and the cane is cut at both top and bottom by circular knives. Then an airplane-type propeller produces a "gale-force" current of air, blowing out the leaves and trash, simultaneously, as the heavy cane is lifted on a conveyor and dropped into a truck. Some harvesters, pulled by tractors, break off the stalks near the roots. The stalks are then piled for handling. After harvesting, the cane is moved to weighing stations and then deposited in railroad cars for transportation to raw sugar mills.

The raw sugar mills are located near the cane fields and operate only during harvest times. When the cane arrives at the mill, washers remove bits of soil and stones accumulated by harvesting. The cane is then crushed by a series of grooved rollers to extract the juice. When the cane fiber reaches the final roller, it is sprayed with hot water to remove the last bit of juice. 2/ The juice is then concentrated in evaporators under vacuum to form a heavy syrup, which is further concentrated in vacuum pans where the sugar is crystallized. Additional crystallization and centrifugal separation follows to produce raw sugar. After this initial processing, the raw sugar is transported to a refinery for final processing.

In contrast to the grinding mills, the cane sugar refineries operate all year round. In order to do this, raw sugar is obtained from different areas with different harvesting seasons. At the refinery, the raw sugar crystals are washed to remove a thin film of molasses which remains after raw sugar mill processing. After washing, the crystals are dissolved in warm water. The resulting syrup is chemically treated

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1/ Francois, p. 39

2/ Bagassee, the fibrous residue, is used as boiler fuel or sold to paper manufacturers for inclusion in certain types of paper.

to extract nonsugars and then filtered to remove these substances. From the pressure filters, the liquid sugar flows through granular carbon and bone-char to remove a slight brownish color. After filtration, the clear liquid is concentrated in evaporators. It then flows to vacuum pans where crystallization begins. To avoid caramelization, the liquid is boiled under vacuum at temperatures as low as 150° Fahrenheit.

From the vacuum pans, the crystals and syrup are emptied into a mixer which agitates the mass until it is ready for the centrifugal machine, a perforated metal basket which spins at a high rate of speed. Spinning throws off the syrup through perforations in the basket. The sugar crystals are left clinging to the sides of the basket and are washed in a spray of water while the basket is still spinning. This process completely separates the sugar crystals from the molasses which remains. The final step in the refining process consists of passing the crystals over four inclined screens which separate the sugar particles by size of granule. This refining process produces 99.9 percent pure sucrose. The pure sugar is finally packaged in many different ways to suit the convenience of specific consumers.

B. Beet Sugar 1/

The sugar beet is a long, silver-white root. The average beet weighs about two pounds and will yield between four and one-half and five ounces of refined sugar. Because of the bulkiness of sugar beets and the small amount of refined sugar obtained per ton of beets processed, it is most economical to locate the beet processing factories near the beet fields. For the same reasons, there is no importation of sugar beets. In the United States, large quantities of sugar beets are grown in the State of California, the northern Rocky Mountain States, and the Red River Valley in Minnesota and North Dakota. Except in California and part of Arizona, beets are planted in the spring and harvested between September and November. In Southern California and the lowland parts of Arizona, beets are planted in the late summer and in the fall and are harvested in the spring. In the rest of California, beets are planted and harvested year round. 2/

1/ The description of these operations was obtained from Sugar Research Foundation, Sugar; United States Beet Sugar Association, The Beet Sugar Story; R. H. Cottrell, Beet Sugar Economics; and a visit to Amstar's Spreckels Division processing plant in Manteca, Calif.

2/ Sugar Statistics, Vol. II, p. 78.

Except in California, sugar beet factories operate only seasonally, Processing begins with the start of the harvest and continues until the entire crop is harvested. In an average year the factories will operate from October until January or February. 1/

In the factory, the beets are first washed and then sliced into the shape of a shoestring potato. The sliced beets are treated with steam and plunged into diffusion tanks with hot water which soaks the sugar from them. 2/ The raw juice, which has a sugar content of only 10 to 15 percent and contains some nonsugar substances, is purified by two main processes. First, the nonsugar substances are rendered insoluble and removed by a filtering process. Precipitation of nonsugar substances is achieved by the use of lime, carbon dioxide, sulfurous acid, and activated carbons. The juice then goes through batteries of filter processes which filter out the now insoluble nonsugars.

After nonsugars are removed, the juice must be thickened before sugar crystals can be formed. Thin juice goes through a series of multiple-effect evaporators where steam is used to remove excess moisture and concentrate the juice. The thick juice now has a sugar content of 50 to 65 percent compared to the 10 to 15 percent it had at the raw juice stage. Further filtration produces a clear liquid called standard liquor which contains liquid sugar. This liquid sugar is now ready for crystallization.

The standard liquor is boiled in huge tanks or vacuum pans, at low temperatures to prevent caramelization, until supersaturization--a ratio of dissolved sugar to water higher than the point of saturation--is achieved. The liquid is then "seeded" by injecting small amounts of pulverized sugar. This process instigates the formation of crystals. Once the crystals reach the desired size, the crystallization process is stopped. The remaining steps in the refining of beet sugar are generally similar to the refining of cane sugar described above. 3/

1/ Telephone conversation with an official of U.S. Beet Sugar Association, January 13, 1975.

2/ The beet pulp which remains is dried, treated with molasses, and sold as cattle feed.

3/ In some plants, additional sugar is extracted from the remaining molasses using the "Steffens" process.

Appendix B: A Sketch of the Early Industrial History of Sugar Refining in the United States

The economist, like the psychoanalyst, can ill afford to neglect the clues provided by the past that help to understand the present. This is particularly true of the refined sugar industry. Not only is its early history fascinating in itself, but it also is of direct relevance to today's industry. The basic market structure appears to have "matured" by about 1910, and until the early 1970's, had not changed in any fundamental way since. In some respects we know a good deal more about the industry between 1887 and 1910 than later because of the voluminous testimony given in connection with the Justice Department's case against the "Sugar Trust." 1/ 2/

Alfred Eichner divides the history of the industry into three stages: The Period of Imperfect Competition, from roughly 1730 to the early 1850's; the Period of Competition, from the 1850's to about 1880; and, finally, the Period of Oligopoly, from 1880 to the present day. The history of the industry over the first two periods, from 1730 to about 1878, will be sketched in the next section. A somewhat more detailed account of the third period will constitute the succeeding section. This Appendix will bring the story up to 1918.

The Period of Imperfect Competition

Nicholas Bayard founded the first sugar "refinery house" in New York City in 1730. Within a few years, refineries were built in Philadelphia, Boston, and Providence. Production processes were very crude and prices relatively high. Although precise figures are unavailable, refiners considered themselves fortunate if they could produce 50 pounds of refined sugar from 100 pounds of raw sugar, a far cry from the 7 percent shrinkage considered normal today. Prices were very high. In Philadelphia, for example, the average price of refined sugar was about 13.5 cents per pound between 1762 and 1775, a period when skilled carpenters and bricklayers earned, at most, 80 cents a day. 3/ While

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1/ United States v. American Sugar Refining Co.,et al., 223 U.S. 743 (1911).

2/ For an exceptionally interesting and detailed account of the evolution of this case, see, Alfred Eichner, The Emergence of Oligopoly: Sugar Refining as a Case Study, Johns Hopkins Press, 1969. This appendix is based mainly on Eichner's work.

3/ Eichner, pp. 27-29.

no direct evidence of profitability exists, indirect evidence suggests that in this early period the business was quite profitable. Many of the great merchant families of the time including the Livingstons, the Cuylers, the Van Cortlands, and the Roosevelts, in New York alone, were associated with the business in this period. The street signs, the public parks and the university buildings in New York City abound with the names of families who pioneered the sugar industry. The main barrier to entry at this time appeared to be the considerable capital required to bring a skilled "sugarmaster" over from Europe and to build the sugar "house" itself.

Things began to change around 1830. Several technological innovations, originating in Europe, were introduced into the United States. The French had discovered that the use of "bone black" or animal charcoal as a filtering agent was much superior to albumen, bullock's blood, or clay which had been used previously. Not only did the use of bone black produce a purer, whiter sugar than these alternative filtering agents; it also made possible derivation of a larger percentage of refined sugar from a given amount of raw sugar. At about the same time, the English were developing an improved device, the vacuum pan, for boiling sugar. These and other innovations were first incorporated successfully in a U.S. refinery by the Stuart brothers in 1832. While the Stuart firm became the predominant firm in U.S., other new firms also entered the industry, employing the most up-to-date technology. The rapid development of railroads during this period also led to an expansion of regional markets. For the first time, eastern seaboard refiners could profitably market their sugar in the Midwest in competition with the Louisiana cane refiners.

The rapid adoption of cost-saving technology combined with the increased competition brought about by new entry and expanding regional markets resulted in a substantial fall in wholesale prices. In 1831 the wholesale price of sugar was about 16 cents a pound. By 1848 the price was halved to 8 cents. The general price level was falling during this period, but at a much slower rate than sugar prices. Refiners' margins, which had been about 5 cents a pound before the Civil War, fell to about 3.5 cents in 1869, and to 1.6 cents by 1877. In 1878 there were 38 independent refiners in New York, Philadelphia, and Boston alone. Entry was apparently easy, as is evidenced by the fact that 3 or 4 new firms entered in New York City each year between 1869 and 1875. To be sure, exit rates were high as well, and firms differed substantially in efficiency, with the most efficient firms able to refine sugar at a margin 5/8 to 7/8 of a cent per pound. The least efficient were just able to survive with a 2 cent margin.

The period from 1830 to the late 1870's was a period of rapid growth, changing technology and changing geographic market structure. Concentration was low, entry easy, and wholesale prices and refiners' margins generally were falling. The industry had all the earmarks of a highly competitive, innovative industry. But forces were already in motion that would change all this and result, within a period of less than 20 years, in one of the most highly concentrated of all U.S. industries.

The Emergence of Oligopoly

The refineries built in the eastern seaboard cities of New York, Boston, and Philadelphia in the 1850's and 1860's tended to be larger and more efficient than the older inland refineries. The Havemeyer and Elder refinery in Brooklyn, for example, not only incorporated all of the most recent technology, but achieved significant warehousing and transportation economies by having the sugar unloaded directly from ships into its warehouses. While there were only a half-dozen or so of these seaboard refineries, by 1877 they produced about 75 percent of the entire U.S. output. So, by 1877, the industry had become fairly concentrated, though it was still behaving in a competitive fashion.

Falling margins caused great difficulties for the small inland refiners. Before the Civil War, margins had been about 5 cents a pound. When the War ended they began to decline rapidly, as Table B-1, shows.

Table B-1: Average Margins Between "Muscovodo" Raw Sugar and Standard "A" Refined

Year	Margins (Cents per pound)
1870	3.47
1871	3.21
1872	2.88
1873	2.55
1874	2.28
1875	2.22
1876	2.07
1877	1.62

SOURCES: David Wells, The Sugar Industry and the Tariff, p. 70. Quoted by Eichner, p. 48.

In 1877 the inland refiners proposed a price-fixing scheme to their larger coastal rivals that would fix the margin at 2.25 cents a pound. The large refiners would not cooperate and attempts to force them into an agreement by getting insurance companies and banks to apply pressure failed. By 1880, however, when the margin had fallen to 1.4 cents, the large refiners did join with the small in a rather sophisticated "pooling" arrangement. As Eichner describes it,

> "At a meeting held on June 1 it was decided that each firm would pay into a common fund one cent for each pound of sugar it refined. The fund was to be divided at the end of each week among the various parties to the agreement according to the melting capacity of each, the latter figure being determined by taking the largest amount of raw sugar melted in any four consecutive weeks prior to the agreement. An executive committee, including Henry and William Havemeyer, was appointed to administer the pool, and refiners were to submit to it daily reports on their meltings. The committee also was given the power to close down certain selected refineries if the price of refined sugar fell below a certain figure. The agreement, signed by most of the refiners in New York, Boston, and Philadelphia, was to last for one year, beginning June 15. 1/"

The pool, however, was short-lived and by 1882 margins continued their downward path.

Efforts to limit competition resumed, but this time they were led by the family that was to dominate the industry for the next 40 years, the Havemeyers. They chose as their model the organizational form employed by John D. Rockefeller in the petroleum industry, the notorious "trust." The trust form was probably suggested to William Havemeyer by a well-known lawyer of the time, John Dos Passos, the father of the novelist who would later chronicle the radical movements of the Great Depression. The small refiners were eager to join the scheme, but some of the larger firms resisted. By the end of October 1887, the trust agreement was finally signed and trust certificates issued for over $44

1/ Eichner, pp. 63-64.

million. The trust included most of the refineries in the East, two in New Orleans, and one in St. Louis. The only important eastern firm refusing to join the trust was Harrison, Frazier & Co. in Philadelphia. Two smaller firms also refused to join, one in Boston and the E. C. Knight firm in Philadelphia. Despite less than complete coverage, the trust was dominant in the East. Refinery margins rose and some plants were left idle. The trust then turned its attention to the West Coast, and, thereupon, became involved in its first war.

The California Sugar Refining Co., owned by Claus Spreckels, was the dominant firm on the West Coast. Spreckels was perhaps the first integrated refiner, having set up the largest sugar plantation in Hawaii immediately after the U.S. Senate ratified a treaty which made it possible for Hawaiian raw sugar to be brought into the U.S. duty free. By 1884 Spreckels' only rival on the West Coast was the American Sugar Refinery. The latter company had entered into various market sharing agreements with Spreckels, but these agreements broke down frequently. John Searles, representing the new trust, visited Spreckels in December of 1887 in the hope of persuading him to join. It was thought that if the dominant firm on the West Coast joined, American would have to follow suit. Spreckels, however, spurned the offer, explaining later that he felt only one or two men would run the trust and he would not be one of them. Rejected by Spreckels, the trust carried out its threat by buying the American Sugar Company and engaging in a price war. The war proved to be much longer and more costly than expected. Through his control over the Hawaiian cane sugar crop, Spreckels was sometimes able to inflict large losses on the American Sugar Company. 1/ But this was not all. Spreckels decided to carry the battle into the trust's home territory, and by early 1890, he had built a refinery in Philadelphia that doubled the capacity of the independent refineries of the East. Within the year, refiner's margins fell by 40 percent to 0.72 cents a pound. The war, however, was soon to end.

The gist of the peace treaty was to give Spreckels control of the West Coast in return for giving the Havemeyers a 45 percent interest in Spreckels' Philadelphia refinery. A new company, the Western Sugar

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1/ See Eichner, pp. 54-55, for a vivid account of one episode.

Refining Company, was formed which leased both of the California refineries. Spreckels was to have 50 percent ownership and the trust (now reorganized as the American Sugar Refining Company) 1/ the other 50 percent. In fact, Spreckels dominated the new company. The two remaining Philadelphia independents, Harrison & Frazier and E. C. Knight, were acquired by the American Sugar Refining Company. The Revere refinery in Boston, with a capacity of less than 2 percent of the U.S. market was the only independent left. By the end of 1891, the American Sugar Refining Co. had achieved a near monopoly of the industry.

The acquisition of E. C. Knight and Harrison & Frazier led the U.S. Government to bring suit under the Sherman Act. In 1894 Judge Butler of the Philadelphia District Court dismissed the Government's complaint. The Supreme Court, in United States v. E. C. Knight, et al., upheld the District Court, declaring in effect that a corporation duly chartered by one of the States was beyond Federal jurisdiction. This was a stunning defeat for the antitrust authorities.

While emerging victorious from its legal battles with the Government, American's problems were not at an end. Refinery margins increased to over 1 cent per pound in 1892 and 1893, and this began to attract new entrants to the business. Three new refineries, one each, in Boston, Brooklyn, and Philadelphia, opened in 1892. This group later merged to form the National Sugar Refining Co., which remains today one of the largest refiners in the country. Henry Havemeyer, as chief officer of American, chose not to oppose the entry of these three new refiners. There were several compelling reasons not to fight. First, at the time these plants opened, Havemeyer was concerned over the possibility of a Government antitrust suit and disturbed by the unfavorable publicity the E. C. Knight and Harrison & Frazier acquisition had brought. Second, American's market share would still be over 80 percent. Third, all three refiners agreed to follow the price posted by American and at least one of the refineries received monthly instructions from American on how much sugar to melt. In order to assure that identical prices would be quoted, particularly west of Ohio, American exchanged lists of prepaid freight rates with the three new companies. All companies were to quote the same rates, using Philadelphia as the basing point. This marked the beginning of the basing point pricing system that survives to this day.

1/ In 1891, for legal reasons, the trust was reorganized as a corporation known as the American Sugar Refining Co. This company is still the largest sugar refiner in the U.S. and is now known as Amstar.

Barriers to Entry

While Havemeyer chose not to fight this first new, but very threatening, entry, he did learn a number of lessons. He concluded that he had placed excessive reliance on the barriers to new entry that American erected. The primary barriers were: rebates from the railroads not to be granted to other refiners; free storage granted by railroads but not available to rivals; an agreement between American and the wholesale grocers that in exchange for a resale price maintenance system enforced by American, the wholesalers would not carry any other refiner's sugar; and last, but not least, the fact that a modern, efficient-scale refinery would have cost at least $1.5 million to build in an industry where capacity was already 20 percent higher than production. For the reasons discussed above, American chose not to use all the weapons at its command. In particular, American let the new entrants share in their agreements with the railroads and participate in their resale price maintenance arrangement with the wholesale grocers. To be sure, the existence of the weapons may have had something to do with the extraordinary cooperative and meek behavior exhibited by the future National Sugar Refining Co.

Still, three new companies had in fact entered the industry, worsening its capacity problems. This might have been prevented had American decided to fight, but they had not and others were encouraged to enter. Havemeyer decided that the refining margins in 1892 and 1893 had simply been too high. A margin of a penny a pound or over was simply too attractive. Havemeyer decided on a target margin of about .875 cents a pound--enough to yield a tidy profit, not enough to encourage too many to try to leap the barriers discussed above. As Table B-2 shows, the industry came close to this target over the next few years, and the margin did not exceed one cent again until after the turn of the century. Havemeyer was an early practitioner of what economists would christen "limit pricing" some 60 or 70 years later. 1/

Entry was not eliminated during the next two decades in spite of these barriers, but much of it was "guided" by American and, in any case, was not sufficient to change the basic concentrated market structure of the industry. There were two substantial threats to the

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1/ For a discussion of the literature on limit pricing, see F. M. Scherer, Industrial Market Structure and Economic Performance, Rand McNally, 1970, pp. 225-34.

Table B-2
Average Prices of Raw and Refined Sugar
For Selected Years, and the Margin Between Them

Year	Raw (96° Test)	Refined (Granulated)	Margin
1879	7.423¢	8.785¢	1.362¢
1880	8.206	9.602	1.396
1881	8.251	9.667	1.416
1882	7.797	9.234	1.437
1883	7.423	8.506	1.083
1884	5.857	6.780	0.923
1885	5.729	6.441	0.712
1886	5.336	6.117	0.781
1887	5.245	6.013	0.768
1888	5.749	7.007	1.258
1889	6.433	7.640	1.207
1890	5.451	6.171	0.720
1891	3.863	4.691	0.828
1892	3.311	4.346	1.035
1893	3.689	4.842	1.153
1894	3.240	4.120	0.880
1895	3.270	4.152	0.882
1896	3.624	4.532	0.908
1897	3.557	4.503	0.946
1898	4.235	4.965	0.730
1899	4.419	4.919	0.500
1900	4.566	5.320	0.754
1901	4.047	5.050	1.003
1902	3.542	4.455	0.913
1903	3.720	4.638	0.918
1904	3.974	4.772	0.798
1905	4.278	5.256	0.978
1906	3.686	4.515	0.829
1907	3.756	4.649	0.893
1908	4.073	4.957	0.884

Table B-2 (Continued)

Year	Raw (96° Test)	Refined (Granulated)	Margin
1909	4.007	4.765	0.758
1910	4.188	4.972	0.784
1911	4.453	5.345	0.892
1912	4.162	5.041	0.879
1913	3.506	4.278	0.772
1914	3.814	4.683	0.869
1915	4.642	5.559	0.917
1916	5.786	6.862	1.076
1917	6.228	7.663	1.435

Note: These margins are not directly comparable to margins given elsewhere in this study because they do not take into account the "shrinkage" of raw sugar through the refining process.

Source: Willet & Gray's Weekly Statistical Sugar Trade Journal, as reprinted in United States v. American Sugar Refining Co., et al.: Testimony Before William D. Price, Special Examiner, pp. 4643-44. Reproduced from Alfred S. Eichner, The Emergence of Oligopoly, p. 343.

existence of the sugar cartel during this period. One was the entry of Arbuckle and Co., a large Pittsburgh based grocery wholesaler, whose companion firm, Arbuckle Bros., was the leading coffee roaster in the United States. The second and potentially more serious threat was the start of the beet sugar industry.

The Arbuckles had achieved their position in the roasted coffee ndustry in large part because they had a patent on a special packaging achine which measured out 16 ounces of coffee, poured the exact amount n a package and sealed it. They adapted the machine for sugar packging but soon discovered that profits in sugar packaging were small. he problem, as the brothers saw it, was that they paid too high a price or wholesale sugar. American would not grant any special discount to rbuckle and, in fact, threatened to stop selling sugar to Arbuckle ltogether, if they continued to package the sugar and resell it under he Arbuckle brand name. American offered to buy the patent rights to he packaging machine, but Arbuckle refused and informed American that hey would go into the refinery business themselves. American's counter hreat was that it would go into coffee roasting if Arbuckle built a ugar refinery. American made good its threat very quickly, purchasing controlling interest in Arbuckle's leading competitor in coffee roastng (Woolson Spice Co.) at the end of 1896. By 1898 Arbuckle Brothers ad opened their sugar refinery and a second front in the price war. offee prices had fallen to unprofitable levels shortly after the entry f American. By 1899, sugar refining margins had fallen to less than .5 cents a pound. This time, American pulled out all the stops against rbuckle and another rival that had entered six months earlier than rbuckle, the New York Sugar Refining Co., led by Claus Doscher. Both ew companies had great difficulties finding wholesalers willing to andle their sugar since, if they did, their price maintenance agreement ith American was threatened. American received rebates from the ailroads not only on the sugar it shipped, but also on the shipments of ts two new rivals. The war lasted two years and died with a whimper. avemeyer virtually supervised a merger of Doscher's firm with several thers. The new firm was the National Sugar Refining Company. While avemeyer did not own National; at least up to 1918, National merely ollowed American's posted prices and had its output regulated by Havemeyer he price war with Arbuckle in both sugar and coffee ended, but by what greement, if any, is unknown.

In 1898 the Congress put a 1.35 to 1.685 cents a pound duty on mported raw sugar which provided a strong stimulus to the growth of a omestic beet sugar industry. Beet sugar factories were established in

California, Colorado and Utah. Havemeyer of American recognized the threat early and set about to put American in control of the emerging beet sugar industry. His first venture was with Bishop Thomas Cutler of the Church of the Latter Day Saints in Utah. In return for a 51 percent interest, American financed the formation of the Utah-Idaho Sugar Co. He followed this initial success elsewhere. In Northern Colorado, American achieved a controlling interest in the Great Western Sugar Co.; in Michigan, the Michigan and Continental companies; in California, Spreckels, American Beet Sugar Co., and several others. By 1907 the Havemeyer family and/or American owned 69 percent of the sugar beet slicing capacity of the U.S. Thus, Havemeyer and American preserved the highly concentrated structure of the industry in spite of some determined attempts to enter and in spite of the growth of a new industry that produced a product which is almost a perfect substitute for its own.

American still had problems: the antitrust case brought by the government in 1911, and its occasional losses through what economists would call the "Segel strategy." The antitrust case, though traumatic, was ended through a consent decree in 1922, which did not require that American divest any of its plants or subsidiaries. The consent decree left the structure of the sugar refining industry intact. The Segel story is a good example of how vulnerable firms following a limit price strategy are to threats. As Eichner tells the story:

> "Adolph Segel was an Austrian immigrant who had made a career of promoting industrial enterprises and then selling them to others. He had already built a match factory and a soap-rendering plant and had succeeded in selling them at a profit to other firms in those industries when, in 1894, he decided to promote a sugar refinery. Organizing the United States Sugar Refining Company, he purchased a tract of land in Camden, New Jersey, and proceeded to erect a plant capable of turning out 1,500 barrels of sugar daily. When the refinery was completed, Segel sat back to wait for an offer from the American Sugar Refining Company.
>
> He did not wait long. In the fall of 1895, shortly after the Camden refinery was completed, Segel received a call from John Dos Passos representing the American Sugar Refining Company. Dos Passos asked Segel how much he wanted for his plant, and Segel mentioned a figure of $1.4 million. Later, however, following the financial panic of 1896, Segel agreed to settle for half that sum,

but even this amount provided him with a profit of between $50,000 and $100,000 on the transaction. After this successful venture, Segel went on to organize companies and build plants which he successfully unloaded on the steel, shipbuilding,and asphalt combinations. Then, in 1901, he decided to have another go at the American Sugar Refining Company. 1/"

Segel did not succeed so well the second time around, mainly because he was in such severe financial difficulties that his threat to actually operate his new refinery was not credible. Nevertheless, even the second time around, he got something out of it and he served as a reminder that healthy margins would attract both bona fide entrants and the Segel strategists.

The sugar refinery industry evolved from its crude monopolistic beginnings in 1730, to a highly competitive industry in the 1850's, to a rather stable oligopoly by 1900. Between 1910 and 1972 the structure of the industy and even the firms in it changed very little. Table B-3 shows the market shares of American, National, and others between 1899 and 1918. Table B-4 gives the market shares for the 14 leading firms in 1972. American had a 31.5 percent share in 1918, and a 27 percent share in 1972, under the name of Amstar. 2/ National had fallen from number two to number five, but was still a power in the industry. Great Western, Amalgamated, Utah-Idaho, Holly, and Michigan were all companies controlled by American in 1907. The number two company, California and Hawaiian, was founded in 1906, by a group of Hawaiian planters who were disgruntled with the low prices Claus Spreckels was paying them for their cane. Much of the later entry (e.g., Borden) was through merger or acquisition rather than through building new capacity. Thus, until the last few years, the sugar refining industry appeared to have "matured" to a degree unusual in the U.S. economy. Within the last two years, there have been some significant changes in the structure of the beet processing segment of the industry. These are dealt with in Chapter III.

1/ Eichner, pp. 282-83.

2/ It is not clear whether the 1918 market share reflects American's beet factory interests. If not, it is not directly comparable to the 1972 figures, since the latter combines Amstar's cane and beet sugar sales.

Table B-3
Domestic Sugar-Market Shares, 1899-1918

Year	American S. R. Co.	National S. R. Co.	Other Cane Producers	Beet Sugar	Imports
1899	67.9	--	28.7	3.1	0.3
1900	67.3	--	28.7	3.1	0.9
1901	57.9	12.1	23.4	4.7	1.9
1902	57.0	13.8	22.8	5.4	1.0
1903	55.2	12.3	22.3	10.0	0.2
1904	58.1	11.8	23.4	6.5	0.2
1905	52.9	11.8	26.4	8.8	0.1
1906	51.0	11.8	26.2	10.9	0.1
1907	49.3	10.8	26.7	13.2	0.1
1908	45.1	10.4	27.6	16.3	0.6
1909	43.1	10.6	31.8	14.0	0.5
1910	42.1	11.1	32.4	13.9	0.5
1911	42.1	--*	41.9	15.5	0.5
1912	38.5	--*	46.1	15.0	0.4
1913	36.3	--*	46.3	17.0	0.4
1914	35.5	--*	47.1	17.0	0.4
1915	34.0	--*	44.4	21.1	0.5
1916	33.6	--*	46.0	20.0	0.5
1917	28.0	--*	49.3	22.6	0.1
1918	31.5	--*	52.3	16.2	--

*Share of market accounted for by National Sugar Refining Company included in share of market accounted for by other cane producers.

Source: Willet & Gray's Weekly Statistical Sugar Trade Journal, first issue of each succeeding year. Reproduced from Alfred S. Eichner, The Emergence of Oligopoly, p. 343.

Table B-4
Leading Sugar Refining Companies,
Sales and Market Shares, 1972

Company	Estimated 1972 Sales (Million $)	Market Share (Percent)
Amstar	$699.6	27.1%
California and Hawaiian	243.3	9.4
Great Western United	180.6	7.0
Savannah Foods and Industries	135.6	5.2
National Sugar Refining	123.9	4.8
Amalgamated Sugar Co.	113.5	4.4
American Crystal Sugar	113.2	4.4
Borden, Inc.	102.5	4.0
CPC International	99.9	3.9
Utah Idaho Sugar Co.	99.9	3.9
Imperial Sugar Co.	99.8	3.9
SuCrest Corporation	94.1	3.6
Holly Sugar	92.0	3.6
Southern Industries	84.8	3.3

Source: Bureau of Economics, Federal Trade Commission. (See, also, tables C-1 and C-2).

Appendix C: Techniques Used in Estimating Plant Sales and in Estimating Regional Concentration

A. Estimation of Plant Sales

A number of sources were used in developing the estimates of sales for the various cane sugar refineries and beet sugar processing plants which appear in Tables C-1 and C-2. In estimating sales of cane sugar, a study by Robert R. Nathan Associates and some figures developed by the Environmental Protection Agency were employed. The Nathan study, which was done for the United States Cane Sugar Refiners' Association, gives the total of 1968 sales for all refineries located in the same city. 1/ The EPA data, which were furnished by the Cane Sugar Refiners' Association, indicate the average daily melt of each cane sugar refinery in the country. The EPA data are reported in Table C-1 and were used to assign sales to individual refineries when multiple refineries were located in the same city. Adjustments were then made to bring the figures into consistency with 1972 value of shipments figures for the cane sugar industry as published by the Bureau of the Census and with company total sales of cane sugar where such numbers were available in company 10-K reports.

In estimating the sales of beet processing plants, the main data employed were plant daily capacity data furnished by the United States Beet Sugar Association. These capacity figures appear in Table C-2. In addition, total 1972 beet sugar sales, as reported by the Bureau of the Census, were allocated among plants proportional to the capacity of each plant. An adjustment was made for plants located in California, where the weather permits plants to operate almost year round. In other areas

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1/ Cane Sugar Refining in the United States: Its Economic Importance; a study by Robert R. Nathan Associates, Inc., for the United States Cane Sugar Refiners' Association, Washington, D.C., 1971.

the processors only operate from October to January or February. 1/ Adjustments were also made where company 10-K reports provided data on total beet sugar sales.

B. Estimation of Regional Concentration

In estimating the concentration of sugar sales by marketing region, use was made of U.S. Department of Agriculture data on inter-regional shipments for 1970. These data show the amount of refined sugar which was shipped from one region to another. 2/ It was assumed that, on a percentage basis, inter-regional shipments patterns have not changed since 1970 and, therefore, it was possible to estimate the value of sugar shipped into a region for the concentration calculations. This assumption probably introduces some minor errors in the calculations, particularly since the California and Hawaiian refinery in Crockett, Calif., was on strike from June 1 to September 22 of 1970. 3/ This causes the shipments from the Lower Pacific region to be smaller than they would be in a normal year. In spite of these problems, the assumption was made because it was felt that these errors were smaller than the errors which would result from ignoring inter-regional shipments.

A second assumption involved in computing regional concentration was that all producers in a region ship their product to another region in proportion to their total production. Thus, if Amstar produces one-third of the sugar produced in the Gulf region, it is assumed that one-third of the sugar shipped from the Gulf region into the Chicago-West region is Amstar sugar. While this assumption is probably reasonable in the Gulf region, where all production occurs very near New Orleans, it is apt to be less accurate in regions like the Southeast or Chicago-West, where production occurs at two or more locations. In those cases, the sugar shipped out of the region is more likely to come from the producing area nearest the region to which the shipment is going. The error introduced by this assumption is apt to be small, and a more complex assumption would have been just as arbitrary and would have significantly increased the cost of the computations.

1/ Phone conversation with an official of United States Beet Sugar Association.

2/ Harry A. Sullivan, "Refined Sugar Movement Within and Among Marketing Territories," U.S. Department of Agriculture, Agricultural Stabilization and Conservation Service, Sugar Reports, No. 240, May 1972, pp. 410.

3/ Ibid.

Table C-1
Estimated Sales for 1972 and Normal Daily
Melt for Cane Sugar Refineries

Company & Plant Location	Normal Daily Melt (thousand kg/day)	Estimated 1972 Sales (Million $)
Amstar		
Brooklyn, N.Y.	1,900	$115.0
Boston, Mass.	900	47.8
Baltimore, Md.	2,350	143.5
New Orleans, La.	2,800	154.2
Philadelphia, Pa.	1,900	97.9
		$558.4
J. Aron and Co. 4/		
Supreme, La.	775	$48.7
Borden, Inc.		
Gramercy, La.	1,350	$74.3
St. Louis, Mo.	275	14.6
Belle Glade, Fla.	350	13.6
		$102.5
CPC International		
Yonkers, N.Y.	1,650	$99.9
California and Hawaiian Sugar		
Crockett, Calif.	3,175	$243.3
Glades County Sugars Growers		
Moore Haven, Fla.	420	$16.3
Imperial Sugar Co.		
Sugar Land, Tex.	1,350	$99.8
Jim Walter Corp.		
Mathews, La.	635	$31.8 1/
National Sugar Refining Co.		
Philadelphia, Pa.	1,900	$123.9 1/

Table C-1 (continued)

Company & Plant Location	Normal Daily Melt (thousand kg/day)	Estimated 1972 Sales (Million $)
Pepsico		
Long Island City, N.Y. 2/	725	$27.8
Savannah Foods and Industries		
Clewiston, Fla.	360	$14.0
Savannah, Ga.	1,700	121.6
		$135.6
Southdown, Inc.		
Houma, La.	635	$35.0
Southern Industries Corp.		
Reserve, La.	1,540	$84.8
SuCrest Corp.		
Brooklyn, N.Y.	750	$45.4
Chicago, Ill.	775	48.7
		$94.1
United Brands		
Charlestown, Mass. 3/	1,090	$58.0

1/ Figures are adjusted so that total company data agree with data in company's 10-K report to U.S. Securities & Exchange Commission.

2/ Pepsico refinery was closed during 1974.

3/ United Brands refinery was sold to SuCrest in April, 1974.

4/ J. Aron and Co. refinery was sold to Archer, Daniels, Midland in July, 1973.

Source: See Appendix C text.

Table C-2
Estimated Sales for 1972 and Daily Capacity
for Sugar Beet Processing Plants

Company & Plant Location	Capacity (tons of beets sliced per day)	Estimated 1972 Sales (Million $)
Amalgamated Sugar Co.		
Nampa, Idaho	9,000	$37.8
Mini-Cassia, Idaho	6,600	27.7
Twin Falls, Idaho	4,600	19.3
Nyssa, Oreg.	6,500	28.7
		$113.5 1/
American Crystal Sugar Co.		
Clarksburg, Calif.	3,000	$18.7
Rocky Ford, Colo.	3,400	14.3
Mason City, Iowa 2/	2,400	10.1
Moorhead, Minn.	4,600	19.3
Crookston, Minn.	4,000	16.8
E. Grand Forks, Minn.	2,900	12.2
Drayton, N. Dak.	5,200	21.8
		$113.2
Amstar		
Chandler, Ariz.	4,200	$26.1
Spreckels, Calif.	6,500	40.5
Manteca, Calif.	4,200	26.1
Woodland, Calif.	3,600	22.4
Mendota, Calif.	4,200	26.1
		$141.2
Consolidated Foods Corp.		
Betteravia, Calif.	5,000	$31.1
Dextra Corp.		
Ottawa, Ohio	1,600	$6.7

Table C-2 (continued)

Company & Plant Location	Capacity (tons of beets sliced per day)	Estimated 1972 Sales (Million $)
Great Western United		
Brighton, Colo.	2,200	$ 8.5
Eaton, Colo.	2,200	8.5
Fort Morgan, Colo.	3,500	13.6
Greeley, Colo.	2,200	8.5
Longmont, Colo.	3,200	12.4
Loveland, Colo.	3,500	13.6
Ovid, Colo.	2,800	10.9
Sterling, Colo.	2,400	9.3
Goodland, Kans.	3,200	12.4
Billings, Mont.	4,200	16.2
Bayard, Nebr.	2,250	8.8
Gering, Nebr.	2,200	8.5
Mitchell, Nebr.	2,250	8.8
Scottsbluff, Nebr.	3,250	12.5
Findlay, Ohio	1,650	6.4
Freemont, Ohio	3,400	13.2
Lovell, Wyo.	2,200	8.5
		$180.6 1/
Holly Sugar Corporation		
Brawley, Calif.	6,500	$22.1
Hamilton City, Calif.	2,800	9.5
Santa Ana, Calif.	1,800	6.1
Tracy, Calif.	4,200	14.3
Delta, Colo.	1,800	4.2
Sidney, Mont.	4,000	9.2
Hereford, Tex.	6,500	14.9
Torrington, Wyo.	3,200	7.3
Worland, Wyo.	1,900	4.4
		$92.0 1/
Michigan Sugar Co.		
Caro, Mich.	2,050	$ 7.1
Carrolton, Mich.	2,350	8.1
Croswell, Mich.	1,450	5.0
Sebewaing, Mich.	2,350	8.1
		$28.3 1/

Table C-2 (continued)

Company & Plant Location	Capacity (tons of beets sliced per day)	Estimated 1972 Sales (Million $)
Monitor Sugar Co., Inc.		
Bay City, Mich.	4,000	$16.8
Utah Idaho Sugar Co.		
Idaho Falls, Idaho	4,400	$21.9
Garland, Utah	2,700	13.4
Moses Lake, Wash.	8,500	44.6
Toppenish, Wash.	3,825	20.0
		$99.9 1/

1/ Figures are adjusted so that total company data agree with data in company's 10-K Report.

2/ Dismantled Feb. 1973.

Source: See Appendix C text.